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THE

UNIVERSITY of MARYLAND

BULLETIN

Graduate School Announcements

1966-1968

The provisions of this publication are not to be regarded as an irrevocable contract between the student and the University of Maryland. The University reserves the right to change any provision or requirement at any time within the student's term of residence. The University further reserves the right, at any time, to ask a student to withdraw when it considers such action to be in the best interests of the University.

GRADUATE SCHOOL ANNOUNCEMENTS

CATALOG SERIES

1966-68

THE UNIVERSITY OF MARYLAND

UNIVERSITY of MARYLAND BULLETIN

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University Calendar, 1965-66

FALL SEMESTER, 1965

SEPTEMBER
- 13-17 Monday through Friday—Fall Semester Registration
- 20 Monday—Instruction begins

NOVEMBER
- 24 Wednesday, after last class—Thanksgiving recess begins
- 29 Monday, 8:00 A.M.—Thanksgiving recess ends

DECEMBER
- 22 Wednesday, after last class—Christmas recess begins

JANUARY
- 3 Monday, 8:00 A.M.—Christmas recess ends
- 17 Monday—Pre-exam Study Day
- 18-24 Tuesday-Monday—Fall Semester Examinations

SPRING SEMESTER, 1966

JANUARY-FEBRUARY
- 31-4 Monday through Friday—Spring Semester Registration
- 7 Monday—Instruction begins
- 22 Tuesday—Washington's Birthday, holiday

MARCH
- 25 Friday—Maryland Day, not a holiday

APRIL
- 7 Thursday, after last class—Easter recess begins
- 12 Tuesday. 8:00 A.M.—Easter recess ends

MAY
- 11 Wednesday—AFROTC Day
- 25 Wednesday—Pre-exam Study Day
- 26-June 3 Thursday through Friday—Spring Semester Examinations
- 29 Sunday—Baccalaureate Exercises
- 30 Monday—Memorial Day, holiday

JUNE
- 4 Saturday—Commencement Exercises

SUMMER SESSION, 1966

JUNE
- 20-21 Monday, Tuesday—Registration, Summer Session
- 22 Wednesday—Instruction begins
- 25 Saturday—Classes (Monday schedule)

JULY
- 4 Monday—Independence Day, holiday
- 9 Saturday—Classes (Tuesday schedule)

AUGUST
- 12 Friday—Summer Session Ends

SHORT COURSES, SUMMER, 1966

JUNE
- 13-17 Monday through Friday—Rural Women's Short Course

AUGUST
- 1-5 Monday through Friday—4-H Club Week

SEPTEMBER
- 6-9 Tuesday through Friday—Fireman's Short Course

University Calendar, 1966-67

(TENTATIVE)

FALL SEMESTER, 1966

SEPTEMBER
12-16 Monday-Friday—Fall Semester Registration
19 Monday—Instruction begins
NOVEMBER
23 Wednesday, after last class—Thanksgiving recess begins
28 Monday, 8:00 A. M.—Thanksgiving recess ends
DECEMBER
21 Wednesday, after last class—Christmas recess begins
JANUARY
3 Tuesday, 8:00 A. M.—Christmas recess ends
18 Wednesday—Pre-exam Study Day
19-25 Thursday-Wednesday—Fall Semester Examinations

SPRING SEMESTER, 1967

JANUARY
31-Feb. 3 Tuesday-Friday—Spring Semester Registration
FEBRUARY
6 Monday—Instruction begins
22 Wednesday—Washington's Birthday, holiday
MARCH
23 Thursday, after last class—Easter recess begins
28 Tuesday, 8:00 A. M.—Easter recess ends
MAY
10 Wednesday—AFROTC Day
24 Wednesday—Pre-exam Study Day
25-June 2 Thursday-Friday—Spring Semester Examinations
28 Sunday—Baccalaureate Exercises
30 Tuesday—Memorial Day, holiday
JUNE
3 Saturday—Commencement Exercises

SUMMER SESSION, 1967

JUNE
19-20 Monday-Tuesday—Registration, Summer Session
21 Wednesday—Instruction begins
24 Saturday—Classes (Monday schedule)
JULY
4 Tuesday—Independence Day, holiday
8 Saturday—Classes (Tuesday schedule)
AUGUST
11 Friday—Summer Session Ends

SHORT COURSES, SUMMER, 1967

JUNE
12-17 Monday-Saturday—Rural Women's Short Course
AUGUST
7-11 Monday-Friday—4-H Club Week
SEPTEMBER
5-8 Tuesday-Friday—Firemen's Short Course

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COMMITTEE ON FACULTY RESEARCH

COMMITTEE ON PUBLIC FUNCTIONS AND COMMENCEMENTS

COMMITTEE ON LIBRARIES

COMMITTEE ON UNIVERSITY PUBLICATIONS

COMMITTEE ON INTERCOLLEGIATE COMPETITION

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COMMITTEE ON COUNSELING OF STUDENTS

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Adjunct Committees of the General Committee on Student Life and Welfare

STUDENT ACTIVITIES

FINANCIAL AIDS AND SELF-HELP

STUDENT PUBLICATIONS AND COMMUNICATIONS

RELIGIOUS LIFE

STUDENT HEALTH AND SAFETY

STUDENT DISCIPLINE

BALTIMORE CAMPUS, STUDENT AFFAIRS

The Graduate School

THE GRADUATE SCHOOL WAS ESTABLISHED IN ITS PRESENT FORM IN 1918 under the jurisdiction of the Graduate Council with the Dean of the Graduate School serving as Chairman. It was created for the purpose of administering and developing programs of advanced study and research for graduate students in all branches of the University. Prior to the present organization some advanced degrees were awarded but they were under the jurisdiction of the individual departments subject to the supervision of the general faculty. Despite the large expansion of graduate programs into new areas as the University has grown, the spirit of each program is essentially that of individual study under competent supervision. The Graduate School is not an extension of the undergraduate program but was created rather for the preparation of those who in the future will carry on the spirit of individual inquiry. Thus it promotes and provides an atmosphere of research and scholarship for both the students and the faculty; in particular, it stimulates that harmonious relationship between the two which results in advancement of learning. At the present time over fifty departments are authorized to offer graduate programs to one or more of the advanced degrees awarded by the University.

The Graduate Council consists of ex-officio, elected and appointed members of the Graduate Faculty and is charged with the formulation of the overall policies of the Graduate School. It meets regularly in March, June and November to consider all matters relating to graduate work brought to its attention by the University Administration, the Graduate Faculty and the Dean of the Graduate School. It may also be called for special meetings throughout the year if urgent business must be transacted.

The Graduate Faculty consists of regular and associate members chosen in accordance with the Plan of Organization of the Graduate Faculty and is listed in the back of this catalog. The direction of individual programs and theses is primarily assigned to the regular members of the Graduate Faculty.

The Graduate Faculty Assembly consists of the regular members of the Graduate Faculty and meets once each year. Special meetings may be called by the Dean of the Graduate School if necessary. In accordance with the University Faculty Organization Plan, it has authority over the educational policy of the Graduate School, may review actions taken by the Graduate Council and serves as a referendum body on questions referred to it by the Graduate Council.

The Dean of the Graduate School serves as chairman and executive officer of both the Graduate Council and the Graduate Faculty Assembly.

The following standing committees are appointed by the Dean of the Graduate School: The Committee on Publications, Committee on Language Requirements, Committee on Graduate Programs and Standards for Graduate Work, Committee on Fellowships and Student Welfare, Committee on Research, Committee on Procedures, Committee on the Graduate Faculty,

and the Committee on Elections. They report annually to the Graduate Council and reports may be requested by the Dean of the Graduate School or by the Graduate Faculty Assembly.

GENERAL INFORMATION

Location

The office of the Graduate School is located in the Business and Public Administration Building, Rooms 112-115, on the College Park campus. This campus is located in Prince Georges County on a large tract of rolling wooded land less than eight miles from Washington, D. C. and approximately thirty-two miles from Baltimore and is served by excellent transportation.

The Baltimore campus of the University is located at the corner of Lombard and Greene Streets, and on this campus the various departments in the Schools of Medicine, Dentistry, Pharmacy and Nursing offer their graduate programs.

Libraries

Libraries of the University are located on the College Park and Baltimore campuses. They consist of the general University Library (the McKeldin Library), the Engineering and Physical Sciences Library, and the Chemistry Library in College Park; and the Health Sciences Library and the Law Library in Baltimore. The libraries have a total book collection of almost 700,000 cataloged volumes, and almost 10,000 periodicals and newspapers are received currently.

In addition to the total of cataloged volumes cited above, the College Park libraries contain over 125,000 U. S. government and United Nations documents, and thousands of phonorecords, maps, negatives, prints, and technical reports.

Bibliographical facilities of these libraries include, in addition to the card catalogs, printed catalogs of other libraries, e.g., British Museum, Bibliothèque Nationale, and Library of Congress, as well as trade bibliographies of foreign countries, special bibliographies of subject fields and similar research aids.

In the McKeldin Library are many study carrels available to graduate students whose study and research require extensive use of library materials. Lockers are likewise available for assignment to graduate students. Facilities for reading microtext materials and for use of typewriters are also provided. Interlibrary loan service from other institutions is provided for those engaged in research.

Within a thirty mile radius of College Park are located the Enoch Pratt Free Library of Baltimore and the unexcelled libraries of the U. S. Government, including the Library of Congress and the National Library of Medicine, and the libraries of Department of Agriculture, Department of Interior, and National Institutes of Health.

For Additional Information

Detailed information concerning the American Civilization Program, fees and expenses, scholarships and awards, student life, and other material of a general nature, may be found in the University publication titled *An Adventure in Learning.* This publication may be obtained on request from the Catalog Mailing Office, North Administration Building, University of Maryland at College Park. A detailed explanation of the regulations of student and academic life may be found in the University publication titled, *University General and Academic Regulations.* This is mailed in September and February of each year to all new undergraduate students.

Requests for course catalogs for the individual schools and colleges should be directed to the deans of these respective units addressed to:

COLLEGES LOCATED AT COLLEGE PARK:

Dean
(College in which you are interested)
The University of Maryland
College Park, Maryland 20740

PROFESSIONAL SCHOOLS LOCATED AT BALTIMORE:

Dean
(School in which you are interested)
The University of Maryland
Lombard and Greene Streets
Baltimore 1, Maryland 21201

ACADEMIC INFORMATION

Admission

An applicant for admission to the Graduate School must hold a bachelor's or a master's degree from a college or university of recognized standing. The applicant shall furnish an official transcript of his collegiate record which for unconditional admission must show creditable completion of an adequate amount of undergraduate preparation of high quality for graduate work in his chosen field. Application for admission to the Graduate School must be made by July 15 for the fall term and by December 15 for the spring term on blanks obtained from the Office of the Graduate School.

Admission to the summer session is governed by the date listed in the Summer School Catalog, which is May 15.

If favorable action on admission is taken before the applicant has completed his undergraduate program, it is understood that the action is conditional and contingent on the receiving of the bachelor's degree named in the application.

Applications for the Graduate School must be accompanied by a $10.00 non-refundable application fee. If the student is accepted for graduate study and enrolls as a graduate student, he will not be assessed the $10.00 matriculation fee.

After approval of the application a matriculation card, signed by the Dean, is issued to the student. This card permits him to register in the Graduate School. It is his certificate of membership in the Graduate School and should be retained by the student *to present at each succeeding registration.* If the student admitted is not enrolled upon the passing of the third registration, the matriculation card becomes invalid and a new application will have to be filed if the student wishes to pursue a graduate program.

At the time of the first registration, an Identification Card will be issued to all full-time graduate students.

Admission to the Graduate School does not necessarily imply admission to candidacy for an advanced degree.

Registration

All students pursuing graduate work in the University, even though they are not candidates for higher degrees, are required to register in the Graduate School at the beginning of each session. *Graduate credit will not be given unless the student matriculates and registers in the Graduate School.* This applies likewise to students who register through University College at locations away from the campus.

The program of work for each session is arranged by the student with the major department and entered upon course cards which are signed first by the professor in charge of the student's major subject and then by the Dean of the Graduate School. One card is retained in the office of the Graduate School. The registration is completed in the Registrar's Office. Students will not be admitted to graduate courses until the Registrar has certified to the instructor that registration has been completed.

A Schedule of Classes, supplementing this catalog, is issued shortly before the beginning of each semester, showing the hours and location of registration and class meetings. This Schedule of Classes is available at the Office of the Registrar.

Graduate Courses

Graduate students must elect for credit in partial fulfillment of the requirements for higher degrees only courses designated *For Graduates* or *For Graduates and Advanced Undergraduates.* Students who are inadequately prepared for graduate work in their chosen fields or who lack prerequisites for minor courses may elect a limited number of courses numbered from 1 to 99 in the general catalog, but graduate credit will not be allowed for these courses. Courses that are audited are registered for in the same way as other courses, and the fees are the same.

Rules Governing Language Examinations for Candidates for the Degree of Doctor of Philosophy

1. A candidate for the doctor's degree must show in a written examination that he possesses a fair knowledge of at least two foreign languages from the list approved by his major department and the Graduate Council, one of which must be either French or German. However, the two languages chosen must not belong to the same language family.

The examinations given in French, German and Russian are the standard doctoral language examinations provided by the Educational Testing Service, Princeton, New Jersey.

Students planning to take the examinations must register in the Office of the Department of Foreign Languages. The times of registration and the place of the examinations will be announced to the departments by the Department of Foreign Languages.

The examinations are held three times a year.

The examinations of these standard doctoral language examinations taken at another institution are recognized by the University of Maryland.
A $6.00 fee is charged for each language examination at the time of registration and is not refundable.

Requirements for the Degree of Doctor of Education

The Doctor of Education degree is offered for students who desire to develop high competence for various types of professional work in Education. The requirements are the same as those for the Doctor of Philosophy degree except for foreign languages and certain specific departmental requirements. For requirements for this degree see Statement of Policy, Doctoral Degrees in Education, available from the Director of Graduate Studies, College of Education.

Program of Work

The professor who is selected to direct a student's thesis work is the student's adviser in the formulation of a graduate program, including suitable

minor work, which is arranged in cooperation with the instructors. To encourage thoroughness in scholarship through intensive application, graduate students in the regular sessions are limited to a program of fifteen credit hours per semester. If a student is preparing a thesis during the minimum residence for the master's degree, the registration in graduate courses should not exceed twelve hours for the semester since the registration in research is required.

Summer Session

The University conducts a summer session at College Park, with a comprehensive undergraduate and graduate program. The University publishes a separate bulletin giving full information on this summer session. This bulletin is available upon application to the Director of the Summer School, University of Maryland, College Park.

Graduate Work in Professional Schools at Baltimore

Graduate courses and opportunities for research are offered in the professional schools at Baltimore. Students pursuing graduate work in the professional schools must register in the Graduate School and meet the same requirements and proceed in the same way as do other graduate students in the other departments of the University.

Oak Ridge Institute

The University is one of the sponsoring institutions of the Oak Ridge Institute of Nuclear Studies located at Oak Ridge, Tennessee. One of the features of this affiliation is the opportunity, in the appropriate fields, for graduate students to do their research problems and prepare their theses under a cooperative arrangement. Such opportunity is limited to those who have completed their course work on the campus, are working in a field where facilities are available, and generally are candidates for the doctoral degree. Successful applicants will receive Oak Ridge Graduate Fellowships with varying stipends depending upon their marital status and dependents. Detailed information can be obtained from the Graduate School office or from Dr. Michael J. Pelczar, Jr., Department of Microbiology, Councilor for the University.

Foreign Students

Graduate students from foreign countries where English is not the native tongue must adequately be prepared to read, write and understand this language. Applicants for admission must pass satisfactorily an English test administered in his native country or at the University of Maryland. The student must be prepared to participate in the course of study and research work as assigned on a full-time basis. A foreign student adviser is available to all graduate students from other countries to discuss matters of immigration.

Since the admission and stay of foreign students are in part dependent on regulations issued by the United States Immigration and Naturalization Service, it is advisable for all graduate students who have been admitted to the Graduate School to consult the foreign student adviser in regard to their immigration status. Students wishing to come to the United States with a student visa must secure an Immigration I-20 Form from the Foreign Student Adviser in order to secure the proper visa from the American consul. Students with student visas already studying in the United States who wish to transfer to the University of Maryland must also secure an I-20 Form from the Foreign Student Adviser in order to request the Immigration and Naturalization Service to grant permission for the transfer.

Every foreign student is expected to see the foreign student adviser as soon as possible after arriving at the University. The adviser will be able to assist not only with various problems regarding immigration, housing, fees, etc., but also with more general problems of orientation to life in the University and the community.

Graduate Work by Seniors in this University

A senior of this University who has nearly completed the requirements for the undergraduate degree may, with the approval of his undergraduate dean, the head of the department concerned, and the Dean of the Graduate School, register in the undergraduate college for graduate courses, which may later be transferred for graduate credit toward an advanced degree at this University. The student must be within seven credit hours of completing his undergraduate work and the total of undergraduate and graduate courses must not exceed fifteen credits for the semester. Excess credits in the senior year cannot be used for graduate credit unless proper prearrangement is made. Seniors who wish to register for graduate credit should apply to the Dean of the Graduate School for information about procedure.

Admission to Candidacy for Advanced Degrees

Application for admission to candidacy for the master's and for the doctor's degree is made on application blanks which are obtained at the office of the Dean of the Graduate School. These are filled out in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. All applications for admission to candidacy must be approved by the Graduate Council.

Admission to candidacy in no case assures the student of a degree, but merely signifies he has met all the formal requirements and is considered by his instructors sufficiently prepared and able to pursue such graduate study and research as are demanded by the requirements of the degree sought. The candidate must show superior scholarship in graduate work already completed.

Application for admission to candidacy is made at the time stated in the sections dealing with the requirements for the degree sought.

Requirements for the degrees of Master of Arts and Master of Science

ADVANCEMENT TO CANDIDACY. Each prospective candidate for the master's degree is required to make application for admission to candidacy not later than the date listed in Important Dates for the semester in which degree is sought. (Copies of Important Dates can be obtained in the Office of the Graduate School). He must have completed at least twelve semester hours in graduate work at the University of Maryland. An average grade of "B" in all major and minor subjects is the minimum requirement. Courses completed with a "D" or "F" in the major and minor must be repeated.

MINIMUM RESIDENCE. A residence of at least two semesters, or equivalent, at this institution, is required.

COURSE REQUIREMENTS. A minimum of twenty-four semester hours, exclusive of thesis and registration for research, with a minimum average grade of "B" in courses approved for graduate credit, is required for the degrees of Master of Arts and Master of Science. The student is also required to register for six semester hours for research and thesis work. The total number of credit hours required for the degree is thirty. If the student is inadequately prepared for the required graduate courses either in the major or minor subjects, additional courses may be required to supplement the undergraduate work. Of the twenty-four hours required in graduate courses, not less than twelve and not more than sixteen semester hours must be earned in the major subject. The remaining credits must be outside the major subject and must comprise a group of coherent courses intended to supplement and support the major work. Not less than one-half of the total required course credits for the degree, or a minimum of twelve, must be selected from courses numbered 200 or above. No credit for the degree of Master of Arts or Master of Science may be obtained for correspondence courses or those taken by examination. The entire course of study must constitute a unified program approved by the student's major adviser and by the Dean of the Graduate School. All requirements for the degree must be completed within an eight-year period.

TRANSFER OF CREDIT. Credit not to exceed six semester hours for course work at other recognized institutions may be applied towards the master's degree only when such course work has been taken after the student has been admitted to the University of Maryland Graduate School. Before taking course work for transfer, the student must have the approval of his adviser and the head of the department in his major field. Normally, approval may be given only for courses which are not offered by the University of Maryland during the period of the student's attendance. The request for transfer of credit shall be submitted to the Graduate Council for approval when the student applies for admission to candidacy. The candidate is subject to final examination by this institution in all work offered for the degree.

Graduate work in the Overseas Programs of the University of Maryland is limited to six hours provided that the student is admitted to graduate studies, that prior approval is obtained from the major professor and the head of the department involved and from the Graduate School. Arrangements for proper registration must be made with the Graduate School.

If a graduate student working for an advanced degree at another institution wishes to take courses at the University of Maryland, his application for admission must be accompanied by a letter from the graduate dean of his institution stating that credit for such courses is acceptable toward his degree.

THESIS. In addition to the twenty-four semester hours in graduate courses, a satisfactory thesis is required of all candidates for the degrees of Master of Arts and Master of Science. (Exceptions are made in the cases of professional degrees). The thesis must demonstrate the student's ability to do independent work and it must be acceptable in literary style and composition. With the approval of the student's major professor and the Dean of the Graduate School, the thesis in certain cases may be prepared *in absentia* under the direction and supervision of a member of the faculty of this institution.

The original copy of the thesis must be deposited in the office of the Graduate School not later than the date listed in Important Dates published annually by the Graduate School. The date published is the deadline for the acceptance of theses but they may be deposited earlier. The thesis should not be bound as the University later binds all theses uniformly. An abstract of the contents of the thesis, not to exceed 250 words in length, must accompany it. A manual giving full directions for the physical make-up of the thesis should be consulted by the student before the typing of the manuscript is begun. Students may obtain copies of this manual from the Students' Supply Store at nominal cost.

FINAL EXAMINATION. The final oral examination is conducted by a committee appointed by the Dean of the Graduate School. The student's adviser acts as the chairman of the committee. The other members of the committee are persons under whom the student has taken most of his major and minor courses. The chairman and the candidate are notified of the members of the examining committee prior to the period set for oral examination. The chairman of the committee selects the exact time and place for the examination and notifies the other members of the committee and the candidate. The examination is normally conducted at the end of the semester, but upon recommendation of the student's adviser, an examining committee may be appointed by the Dean of the Graduate School at any time when all other requirements for the degree have been completed. A report of the committee is sent to the Dean as soon as possible after the examination. A special form for this purpose is supplied to the chairman of the committee and the approval must be unanimous. Such a report is the basis upon which recommendation is made to the faculty that

the candidate be granted the degree sought. The period for the oral examination is usually about one hour, but the time should be long enough to insure an adequate examination.

The examining committee also approves the thesis, and it is the candidate's obligation to see that each member of the committee has ample opportunity to examine a copy of the thesis prior to the date of the examination. A student will not be admitted to final examination until all other requirements for the degree have been met. In addition to the oral examination, a comprehensive written examination may be required at the option of the major department.

Requirements for the Degrees in American Studies

The American Studies Program is designed to prepare the candidate for teaching, both on the secondary as well as college levels; for research in American culture; and for professional work which requires the interpretation of American culture, such as journalism, library work, and foreign cultural posts. The Program provides a background in the culture of the United States by applying the disciplines of literature, history, art, and philosophy. The approach is by means of historical perspective. A core of four courses in American Studies forms the basis of the Program, which is supplemented by appropriate offerings from the departments of English, History, Art, and Philosophy. The candidate will stress work in two of these departments when he determines his course of study. Normally one of the two fields must be American history or American literature.

The candidate for a degree must pass a final written examination testing his understanding of American civilization in terms of his individual program of studies. However, students will be expected to show proficiency in the literary, historical, artistic, and philosophical aspects of American culture.

MASTER OF ARTS. After the candidate has been admitted to graduate work, he is to be counseled by the general graduate adviser in American Studies. He may then be referred by the general adviser to the appropriate subject matter specialist within the department. With the approval of his adviser, a candidate for the Master of Arts degree with a major in American studies may elect in lieu of the thesis six additional hours of course work. The total number of credit hours required for the degree would then be thirty semester hours. However, the candidate who intends to work for the doctorate must write a thesis. Each candidate must present credits for at least *fifteen semester hours* of work *in two of the four cooperating departments,* and credits for at least fifteen semester hours in supporting courses (nine hours if a thesis is elected). The Seminar in American Studies is a required course, as is the course in bibliography and research methods given by the English or History departments.

All other requirements are the same as for the degree of Master of Arts and Master of Science in other fields.

DOCTOR OF PHILOSOPHY. The candidate must apply in writing to the Director of the American Studies Program for permission to work for the Doctorate. Successful completion of the Master of Arts requirements does not assure permission. The candidate should have written a Master's thesis; if he has not, he must have an outstanding record. The candidate is required to take a preliminary exploratory oral examination as soon as he feels adequately prepared in one inter-disciplinary topic or subject, normally within his field of greatest interest. Doctoral candidates with the Master's degree from this university are exempted from this requirement.

The general requirements for the degree of Doctor of Philosophy in American Studies are the same as those for the doctoral degree in other fields.

Requirements for the Degree of Master of Education

The Master of Education degree is designed to increase competency for various positions in Education. In those major areas where it is applicable, up to half of the course work may be taken in the teaching field. Course work, seminar papers, and other requirements such as comprehensive examinations are substituted for thesis. For requirements for the degree see Statement of Policies and Procedures, Master's Degrees in Education available from the Director of Graduate Studies, College of Education.

Requirements for the Degree of Master of Business Administration

The Master of Business Administration program is designed primarily to prepare students for positions of responsibility in business and government. Emphasis is placed on the development of analytical ability and reasoned judgment in decision making. Instructional methods include case analysis, seminar discussion and decision simulation. Computer familiarization is provided.

A core of four courses embraces the areas of business decisions central to the firm's operation; relevant analytical methods, especially quantitative techniques; behavioral factors affecting the managerial task and the environment in which business functions, especially its relationships with government.

Beyond the core, further advanced work may be taken in Management and in Statistics, and a concentration may be undertaken in a field of special interest: Accounting, Finance, Marketing, Personnel and Industrial Relations, and Transportation.

Among the factors which are considered in admission of students for graduate work in Business are an undergraduate record evidencing high scholastic attainment and performance on the required Admission Test for Graduate Study in Business.

The Admission Test for Graduate Study in Business is offered four times a year through the Educational Testing Service, Princeton, New Jersey. The test is not designed to test specific knowledge in specialized academic subjects and normal undergraduate training provides sufficient general knowledge to answer the test questions. A bulletin of information (which includes an application for the test) should be obtained six weeks in advance of the desired test date, from Admission Test for Graduate Study in Business, Educational Testing Service, Princeton, New Jersey. Applications and fees must reach ETS at least two weeks before the desired test administration date. ETS establishes regular test centers throughout the country and abroad and the bulletin contains a list of these centers.

Individuals who are qualified are accepted not only from the area of undergraduate business administration but from other areas, such as engineering, the sciences, the arts, the humanities, and other fields. The Graduate program is offered in the day school and is conducted on the campus.

Those students whose major undergraduate work has been in areas other than business are required to complete certain basic core requirements in business and economics with a 'B" average before being admitted to candidacy for the degree of Master of Business Administration. These core course requirements are listed below:

Principles of Economics	6 hours	Marketing	3 hours
Principles of Accounting	6 hours	Management and Organization Theory	3 hours
Business Law	3 hours	Business Finance	3 hours
Statistics	3 hours		

COURSE REQUIREMENTS for the degree of Master of Business Administration are:

A minimum of thirty semester hours must be completed in courses numbered 200 or above. A minimum average of "B" must be earned in these courses. If the student is inadequately prepared for the required graduate courses, additional courses may be required to supplement the undergraduate work. Of the thirty hours required in graduate courses, not less than six and not more than nine must be taken in a major subject. Courses covering the remaining credits must be taken outside the major subject and must comprise a coherent group, as approved by the student's advisor. No credit for the degree of Master of Business Administration may be obtained for correspondence courses or those taken by examination. The entire course of study must constitute a unified program approved by the student's advisor and by the Dean of the Graduate School. All requirements for the degree must be completed within an eight-year period.

The other requirements for the degree are the same as for the degrees of Master of Arts and Master of Science.

Requirements for the Degree of Master of Music

Four areas of specialization are provided in the Master of Music program to allow the student to pursue advanced work in the area for which his experience and interest have best prepared him. (1) Specialization in the history and literature of music leads to a study of musical styles and literatures and of the methods and materials of systematic musicology. Each candidate must demonstrate that he possesses a reading knowledge of one foreign language. A thesis is required in which mastery of musicological method must be shown. (2) Specialization in theory leads to advanced work in analysis and the use of musical materials. A thesis of an analytical nature will normally be required. (3) Specialization in composition leads to the development of creative ability. A thesis consisting of an original composition of major proportions will be required. (4) Specialization in performance leads to advanced work in the history, literature, and theory of music, and will combine seminars in the literature of a particular instrument with advanced instruction in that literature. In this approach the final project will consist of a seminar paper of an analytical nature and a graduate-level recital containing the works covered in the paper.

At least nine semester hours of the thirty required for the degree will normally be in a field of music outside the area of specialization (music theory in the case of the history-literature concentration, for example), and will constitute the minor area. In exceptional cases a student may take minor courses (no more than nine hours) in a field outside music. History, Philosophy, Music Education, American or English Literature, and Foreign Languages are among the recommended minor fields.

All other requirements are the same as for the degree of Master of Arts.

Requirements for the Degree of Master of Library Science

The School of Library and Information Services offers course work leading to the degree of Master of Library Science designed to prepare students for professional practice in library and information service in each of the specialties of the field from children's work to information retrieval. The program constitutes a 36-hour course of study, normally to be completed in two semesters followed by a summer session, or the equivalent of part-time study over a more extended period. There is no thesis or comprehensive examination required.

Additional details may be obtained by addressing a request to: The School of Library and Information Services, McKeldin Library, University of Maryland, College Park, Maryland 20740.

Requirements for the Degree of Master of Social Work

The School of Social Work offers work leading to the degree of Master of Social Work with a concentration in social casework. Concurrent field instruction is provided in cooperative arrangement with affiliated social agencies throughout Maryland.

Two academic years of full-time study are required for completion of the School's requirements, except that a limited number of part-time students are permitted to enroll for designated courses.

A comprehensive examination is given late in the semester in which the student completes requirements for the degree.

Additional details may be obtained by addressing a request to: The School of Social Work, University of Maryland, 721 West Redwood Street, Baltimore, Maryland 21201.

Requirements for the Advanced Graduate Specialist Program

The Advanced Graduate Specialist program is designed for those who wish to develop high professional competence in an area of specialization. Students who wish to pursue this program must be admitted to the Graduate School, and must have the master's degree or its equivalence. The program leads to a diploma which is awarded by the College of Education. For requirements for this diploma see Statement of Policies and Procedures, Advanced Graduate Specialist Program in Education, available from the Director of Graduate Studies, College of Education.

Requirements for the Degree of Doctor of Philosophy

ADVANCEMENT TO CANDIDACY. Candidates for the doctor's degree must be admitted to candidacy at least one academic year prior to the conferring of degrees. Applications for admission to candidacy for the doctor's degree are made in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. Blanks may be obtained at the office of the Graduate School.

Before admission to candidacy the applicant must have demonstrated to the Head of the Foreign Language Department that he possesses a fair knowledge of at least two foreign languages from the list approved by his major department and the Graduate Council, one of which must be either French or German. However, the two languages chosen must not belong to the same language family.

Preliminary examinations or such other substantial tests as the departments may elect are also required for admission to candidacy.

The student must complete all of his program for the degree, including the thesis and final examination, *during a four-year period after admission to candidacy.* Failure to do so requires another application for admission

to candidacy with the usual preliminary examination unless the Graduate Council rules otherwise.

RESIDENCE. The equivalent of three years of full-time graduate study and research is the minimum required. Of the three years the equivalent of at least one year must be spent in residence at the University. On a part-time basis the time needed will be correspondingly increased. All work at other institutions offered in partial fulfillment of the requirements for the Doctor of Philosophy degree is submitted to the Graduate Council for approval, upon recommendation of the department concerned, when the student applies for admission to candidacy for the degree.

The doctor's degree is not given merely as a certificate of residence and work, but is granted only upon sufficient evidence of high attainments in scholarships, and ability to carry on independent research in the special field in which the major work is done.

MAJOR AND MINOR SUBJECTS. The candidate must select a major and one or two closely related minor subjects. At least twenty-four semester hours of course work, exclusive of research, are required for the minor. Of the twenty-four semester hours at least eight hours must be at the 200-level unless special permission is granted beforehand. If two areas are chosen for the minor requirement not less than nine semester hours may be presented in either area. The remainder of the required residence is devoted to intensive study and research in the major field. The amount of required course work in the major subject will vary with the department and the individual candidate. The candidate must register for a minimum of twelve semester hours of research at this institution.

THESIS. The ability to do independent research must be shown by a dissertation on some topic connected with the major subject. An original typewritten copy and one clear, plain carbon copy of the thesis, together with an abstract of the contents, not to exceed 600 words in length, must be deposited in the Office of the Graduate School on the scheduled date. The date published is the deadline for the acceptance of theses but they may be deposited earlier. It is the responsibility of the student also to provide copies of the thesis for the use of the members of the examining committee prior to the date of the final examination.

The original copy should not be bound, as the University later binds uniformly all theses for the general University Library. The carbon copies are bound by the student in cardboard covers which may be obtained at the Students' Supply Store. The abstracts are published by University Microfilms.

A manual giving full directions for the physical make-up of the thesis should be consulted by the student before typing of the thesis is begun. Students may obtain copies of this manual at the Students' Supply Store.

FINAL EXAMINATION. The final oral examination is held before a committee appointed by the Dean. One member of this committee is a repre-

sentative of the Graduate Faculty who is not directly concerned with the student's graduate work. One or more members of the committee may be persons from other institutions who are distinguished scholars in the student's major field.

The duration of the examination is approximately three hours, and covers the research work of the candidate as embodied in his thesis, and his attainments in the fields of his major and minor subjects. The other detailed procedures are the same as those stated for the master's examination.

Requirements for the Degree of Doctor of Musical Arts

The Doctor of Muscial Arts degree is offered for students who wish to undertake work on the highest level in either of two areas—composition or literature-performance—in order to develop excellence as composers, performers, or teachers. A balance between scholarly (research) and professional (creative) work is a basic element of the program.

COMPOSITION. The applicant must hold bachelor's and master's degrees, or the equivalent, in composition and must submit an adequate number of his original works as evidence of his musical maturity and creative ability. Placement and qualifying examinations, the presentation of a lecture recital and a program of his own compositions, and the successful completion of the doctoral foreign-language requirement are prerequisites for admission to candidacy. The thesis will be a composition of major proportions, typically a symphony, concerto, ballet, or chamber opera.

LITERATURE-PERFORMANCE. The applicant must hold bachelor's and master's degrees, or the equivalent, in the area of specialization, and must perform an audition recital that includes representative repertoire from the various historical periods. Placement and qualifying examinations, the presentation of a lecture recital and a full-length recital, and the successful completion of the doctoral foreign-language requirement are prerequisites for admission to candidacy. After admission to candidacy the student must complete his thesis and perform a final recital.

FOREIGN-LANGUAGE REQUIREMENT. The Department requires a reading knowledge of French, German, or Italian, and the passing of an examination covering the meaning of musical terms in French, German, and Italian.

Other requirements pertaining to admission, residence, etc., are the same as those for the Doctor of Philosophy degree. Details of the program may be obtained from the Department of Music.

Requirements for the Doctor of Business Administration

The Doctor of Business Administration degree is designed for those planning to teach business administration subjects at the university level and for those preparing for research or management responsibilities in industry, government and universities.

Admission to the program is based upon: (1) excellence in both undergraduate and graduate work, (2) the Admission Test for Graduate Study in Business (see description under the M.B.A. degree), (3) reports of academic observers on the applicant's work, and (4) other evidences of promising scholarship.

PROGRAM REQUIREMENTS. Candidates for the Doctor of Business Administration degree are required to develop competence in the following five concentrations:

(1) Financial Administration
(2) Human Behavior in Business
(3) Quantitative Methods
(4) Business Logistics
(5) Management

Requirements under the five basic concentrations may be fulfilled through approved combinations of work in the following fields: Accounting, Finance, Organization Theory, Personnel Administration, Labor and Industrial Relations, Statistics, Operations Research, Mathematics, Computer Science, Marketing, Transportation, Production Management, and Public Policy.

COURSE REQUIREMENTS. The following work beyond the bachelor's degree is required as the minimum essential preparation for the candidate's general qualifying examinations. Additional work may, in certain instances, be necessary or desirable.

	Semester Hours
Major Concentration (One of the 5 above)	24
Minor Concentrations (Not less than 6 hours in each)	24
Quantitative Methods (Required for All Candidates)*	12
Research Methodology	3
Economics—(Economics 200, Micro-Analysis Economics 202, Macro-Analysis)	6
Electives	9

A "B" average must be maintained on courses taken for the degree.

CREDIT FOR GRADUATE WORK. Graduate work taken at other universities may be applied as credit toward the D.B.A. requirements if of appropriate level and relevance to the candidate's program, but at least thirty hours of residence work beyond the bachelor's degree must be taken as terminal doctoral requirements at this university.

While candidates may be awarded the Doctor of Business Administration degree without having first received the M.B.A. degree, they are strongly advised to complete requirements for the M.B.A. before seeking admission to the D.B.A. program.

*Two years of undergraduate mathematics, Math. 10, 11, 14, 15, or equivalent, must be taken as prerequisites to the graduate quantitative requirements.

Course work taken for the M.B.A. may be credited toward the doctoral degree. but undergraduate business "core courses" (see description under the M.B.A. requirements) may not be so credited.

EXAMINATIONS. Candidates are required to complete written examinations in each of the five concentrations noted above. Following the written examinations. the candidate is examined orally by a committee of the graduate faculty. Candidates must apply and be advanced to candidacy for the D.B.A. degree *one academic year before the degree is awarded.*

THE DISSERTATION. A written dissertation, exhibiting competence in the analysis. interpretation, and presentation of research findings is required of all candidates. Each candidate is required to register for 12 semester hours of thesis counseling.

Upon being advanced to candidacy, the candidate must present to his appointed dissertation committee a *Dissertation Proposal,* which sets forth objectives of the research plan, its scope, methodologies to be employed, types and sources of data to be sought, and time requirements for completion. When approved, the candidate completes the dissertation under direction of his committee. An examination on the dissertation is conducted by a committee of the graduate faculty.

Graduate Fees

The fees paid by graduate students are as follows:

Application fee, $10.00. (See page 4).

Matriculation fee of $10.00. This is paid only once, upon first registration in the Graduate School.

Graduation fee for master's degree, $10.00.

Graduation fee for doctor's degree including a hood, microfilming and binding of thesis, and publication in *Dissertation Abstract,* $50.00.

Tuition fee. A fixed charge of $24.00 per semester credit hour.

Foreign Language Examination, $6.00.

Testing fee for education majors, $5.00.

Laboratory fees, where charged, range from $1.00 to $20.00 per semester course.

Infirmary fee. $5.00 (College Park only). All full-time students are charged the fee of $5.00 for the academic year. Heads of departments will designate status of graduate students.

Vehicle Registration Fee, each vehicle, $2.00. (Payable each academic year by all students registered for courses on the College Park Campus and who drive on the campus.)

There is a $3.00 fine for violation of the University parking regulations. All graduate students are expected to abide by these regulations, regardless of full-time or part-time attendance. The failure to register for a parking permit entails a $5.00 fee.

An Adventure in Learning, the undergraduate catalog of the University, contains a detailed statement of fees and expenses and includes changes in fees as they occur. A copy may be requested from the Catalog Mailing Office, North Administration Building, University of Maryland at College Park.

LIVING EXPENSES AND SELF-HELP. The University in no way assumes responsibility for the housing of graduate students.

Board and lodging are available in many private homes in College Park and Baltimore. The cost of board and room varies from about $120.00 to $150.00 a month, depending upon the desires of the individual. For College Park only, a list of accommodations is maintained by the Housing Bureau in the Office of the Dean of Men.

Application for student employment, aside from fellowships and assistantships, may be made through the Offices of the Dean of Men and the Dean of Women, or to department heads.

FELLOWSHIPS AND ASSISTANTSHIPS

FELLOWSHIPS. A number of fellowships have been established by the University. The stipend for the University fellows is $1,000.00 for nine months and the remission of all graduate fees except the graduation fee. Several industrial and special fellowships, with varying stipends, are also available in certain departments.

University Fellows are permitted to carry a full graduate program, and they may satisfy the residence requirement for higher degrees in the normal time.

Applications for fellowships are made on blanks which may be obtained from the Office of the Graduate School. The application with the necessary credentials, is sent by the applicant directly to the Dean of the Graduate School.

Applications are forwarded by the Dean to the departments for their consideration and recommendation. The awards of University fellowship are on a competitive basis.

GRADUATE ASSISTANTSHIPS. A number of teaching and research assistantships are available in several departments. The compensation is at a rate of $240.00 per month unless otherwise specified and varies with the nature and amount of service required and with the terms of appointment. The amount of credit allowed toward a degree is normally a maximum of ten credit hours in a regular semester. The research assistants usually participate in research that meets the requirements for a master's or a doctor's degree.

Applications for graduate assistantships are made directly to the departments concerned and appointments are made through the regular channels for staff appointments. Further information regarding these assistantships may be obtained from the departments concerned.

RESIDENCE COUNSELING GRADUATE ASSISTANTSHIPS. A limited number of assistantships are available to graduate men students to act as supervisors in undergraduate residence halls. To qualify, persons must receive full status in the Graduate School, must have outstanding leadership qualities and must be single. Remuneration for all residence assistantships is $2,400.00 per academic year, remission of Graduate School fees and room charges. Further information about these assistantships may be obtained from the Office of the Director of Housing.

Similar residence assistantships are available for graduate women students contingent upon acceptance to the Graduate School. They should offer evidence of leadership ability and interest in working with people. Graduate assistants live in the residence halls with students and serve as counselors and group advisors under the supervision of the director of residence and the student personnel staff. Remuneration for the assistantship is $2,400.00 per academic year, remission of Graduate School fees and room charges. Board and room charges must be paid by the student.

For further information about these assistantships women applicants should write to the Office of the Dean of Women.

GRADUATE PRIZE OF THE COLLEGE PARK BRANCH, AAUW

A Graduate Prize of $100.00 will be awarded annually by the College Park Branch of the American Association of University Women to an outstanding woman student working for an advanced degree at the University of Maryland. The selection will be made by the Scholarship Committee of the Branch from candidates recommended by departments and the Graduate School.

STUDENT LOAN FUNDS

National Defense Education Act Loan Funds are available to graduate students of the University of Maryland up to $2,500.00 per year. Such applications should be directed to Mr. H. Palmer Hopkins, Director, Office of Student Aid, North Administration Building, University of Maryland at College Park, Maryland.

A Student Loan Fund is maintained by the College Park Branch of the American Association of University Women. It is administered through the Office of the Dean of Women, and is available to deserving women who are graduate students at the University of Maryland.

Likewise the Sigma Chapter of Phi Delta Gamma Fraternity for Graduate Women provides loans to graduate women of the University of Maryland.

For further information contact the office of the Graduate School.

Commencement

Attendance is required at the June commencement if the degree is conferred at that time.

Application for diploma must be filed in the Office of the Registrar eight weeks before the date at which the candidate expects to obtain a degree except during the summer session (see *Important Dates*).

Academic costume is required of all candidates at the June commencement. Those who so desire may purchase or rent caps and gowns at the Students' Supply Store. Orders must be filed eight weeks before the date of convocation but may be cancelled later if the student finds himself unable to complete his work for the degree.

Method of Numbering Courses and Counting Credit Hours

Courses for Advanced Undergraduates and Graduates are numbered 100 to 199; courses for Graduates only are numbered 200 and upward.

A course with a single number extends through one semester.

A course with a double number extends through two semesters.

The number of semester hour credits is shown by the arabic numerals in parentheses after the title of the course. Examples:

Course 101. Title (3).
First semester.
If a laboratory course:

Course 101. Title. (3)
One lecture and two laboratory periods a week, first semester.
(This is a semester course: offered once a year.)

Course 101. Title. (3)
First and second semester.
(This is a semester course, repeated each semester, and except for research, seminar, and certain problem courses, must be taken only one semester.)

Course 103, 104. Title (3, 3).
Three hours a week, first and second semesters.
If a laboratory course:

Course 103, 104. Title (3, 3).

One lecture and two laboratory periods a week, first and second semesters.

(This is a course extending through two semesters and carrying three semester credits each semester.)

Course 103, 104. Title (3, 3).

Three hours a week, second and first semesters.

(This is a course extending through two semesters, but it begins with the second semester.)

Course 105, *f, s.* Title (3, 3).

Three hours a week, first and second semesters.

(This is an alternate way of listing a two-semester course.)

GRADES

The following symbols are used for grades: "A," "B," "C" and "S"—Passing; "D" and "F"—Failure; "I"—Incomplete. Since graduate students must maintain an overall "B" average, every credit hour of "C" in course work must be balanced by a credit hour of "A." A grade of "A" in thesis research will not balance a grade of "C" in a course. *All incomplete grades must be removed before the degree is conferred.*

Curricula and Courses

AEROSPACE ENGINEERING

Professors: SHERWOOD, CORNING, AND WESKE.

Associate Professors: MELNIK, RIVELLO, AND SCHETZ.

Lecturers: BILLIG, LOBB, PAI, AND WILSON.

Instructors: LUBARD, REDDY, AND REILLY.

The Department of Aerospace Engineering offers courses and opportunities for research leading to the degree of Master of Science and Doctor of Philosophy in aerospace engineering.

Facilities for graduate research include two subsonic and two supersonic wind tunnels, a shock tube, a ballistic range and complete structural loading and measuring equipment for both static and dynamic conditions.

For Graduates and Advanced Undergraduates

AE. EN. 101. AERODYNAMICS I. (3)
First semester. Three lectures a week. Prerequisite, Phys. 21. Basic fluid mechanics and aerodynamic theory. (Melnik.)

AE. EN. 102. AERODYNAMICS II. (2)
Second semester. Two lectures a week. Prerequisite, Aero E. 101. Elements of compressible flow and application to engineering problems. (Sherwood.)

AE. EN. 107, 108. DESIGN OF AEROSPACE VEHICLES. (4, 4)
First and second semesters, two lectures and two lecture calculation periods a week. Prerequisites, Aero. E. 101, 102 and 113; first semester, theory background and methods of airplane design, subsonic, supersonic and VTOL; second semester, theory background and methods of space vehicle design, manned orbiting vehicles, manned Lunar and Martian landing systems. (Corning.)

AE. EN. 109, 110. FLIGHT PROPULSION. (3, 3)
Two lectures and one laboratory period a week. Prerequisite, M. E. 1 and Ae. En. 101. Operating principles of piston, turbojet, turboprop, ramjet, and rocket engines. Thermodynamic processes and engine performance, aero-thermochemistry of combustion, fuels and propellants, energy for space flight. (Weske.)

AE. EN. 111, 112. ELECTIVE RESEARCH. (2, 2)
One lecture and one laboratory period a week. Prerequisites, Ae. En. 102 and Ae. En. 113. Wind tunnel tests; structure tests. Written and oral reports on original research projects. (Staff.)

Ae. En. 113, 114. Flight Structures. (4, 3)

First semester, three lectures and one calculation period a week; second semester, three lectures a week. Prerequisites, E. S. 20 and Math. 64. Principles and problems of stress analysis and structural design of flight structures. (Rivello.)

Ae. En. 115. Aerodynamics III. (3)

Prerequisite. Ae. En. 102. Elementary theory of the flow of an incompressible fluid. (Sherwood.)

Ae. En. 117. Aircraft Vibrations. (3)

Three lectures a week. Prerequisite, Math. 64. Vibration and other dynamic problems occurring in structures. Specific topics of study include the single degree of freedom system, damping, forced vibrations, critical frequency multiple degrees of freedom. and vibration isolation and absorption. (Schetz.)

Ae. En. 118. Dynamics of Aerospace Vehicles. (3)

Second semester. Prerequisites. Aero. E. 101. 102. 115. Stability, control, loads and miscellaneous topics in dynamics. (Corning.)

For Graduates

A. BASIC AERODYNAMICS

Ae. En. 220, 221. Aerodynamics of Incompressible Fluids. (3, 3)

Prerequisites. Ae. En. 101. Ae. En. 102. Math. 66. Fundamental equations in fluid mechanics. Irrotational motion. Circulation theory of lift. Thin airfoil theory. Lifting line theory. Wind tunnel corrections. Propeller theories. Linearized equations in compressible flow. (Schetz.)

Ae. En. 222, 223. Aerodynamics of Viscous Fluids. (3, 3)

Prerequisites. Ae. En. 101, Ae. En. 102, Math. 66. Fundamental concepts. Navier-Stokes' equations. Simple exact solutions. Laminar boundary layer theory. Pohlhausen method. Turbulent boundary layer; mixing length, similarity and statistical theories and their applications. Boundary layer in compressible flow. (Weske.)

Ae. En. 224, 225. Aerodynamics of Compressible Fluids. (3, 3)

Prerequisites. Ae. En. 115. Math. 66. One dimensional flow of a perfect compressible fluid. Shock waves. Two-dimensional linearized theory of compressible flow. Two-dimensional transonic and hypersonic flows. Exact solutions of two dimensional isotropic flow. Linearized theory of three-dimensional potential flow. Exact solution of axially symmetrical potential flow. One-dimensional viscous compressible flow. Laminar boundary layer of compressible fluids. (Pai.)

B. APPLIED AERODYNAMICS

Ae. En. 230, 231. The Aerodynamics of High Altitude Vehicles. (3, 3)

Prerequisite, permission of instructor. Aerothermodynamic study of several types of high altitude, hypersonic vehicles including ballistic, boost-glide and satellite vehicles. Examination of problems in stability, control, boundary-layer growth, shockwave interactions and convective and radiative heating. (Wilson.)

Ae. En. 232, 233. Wave Propagation in Gases and Solids. (3, 3)

Prerequisite, permission of instructor. Application of method of characteristics to unsteady compressible flow. Study of isentropic and non-isentropic flows of both ideal and non-ideal gases. The Lagrange ballistic problem, detonation, the shock tube and spherical waves. Impact loading on elastic-plastic materials, the stopping shock, interactions and reflections in solids. Stress and strain produced in solids with varying cross-sectional area. (Seigel.)

Ae. En. 234, 235. Aerospace Facilities and Techniques. (3, 3)

Prerequisite, permission of instructor. Problems in supersonic and hypersonic tunnel development such as the aerodynamic design of nozzles, diffusers, storage systems and arc heaters. Shock tubes and shock tube wind tunnels. Development of ballistic ranges and basic considerations in the design of high-speed launchers. Instrumentation and data reduction. (Lobb.)

Ae. En. 236, 237. Heat Transfer Problems Associated with High Velocity Flight. (3, 3)

Prerequisite, permission of instructor. Heat conduction in solids and thermal radiation of solids and gases. Analytic solutions to simple problems and numerical methods for solving complicated problems. Convective heating associated with laminar and turbulent boundary-layer flow. Heat transfer equations are derived for the flat plate case and for selected body shapes such as cones and hemispheres. Real gas effects on convective heating are examined. (Wilson.)

C. STRUCTURES

Ae. En. 250, 251. Advanced Flight Structures. (3, 3)

Prerequisites, Math. 66 and Ae. En. 113, 114, or permission of the instructor. Advanced topics in structural theory with applications to flight vehicle structures. Energy and matrix methods, plate theory, introduction to shell theory. (Rivello.)

D. PROPULSION

Ae. En. 260, 261. Advanced Propulsion. (3, 3)

Prerequisites, M. E. 1; Ae. En. 109, 110. Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines; plasma, ion and nuclear propulsion for space vehicles. (Billig.)

E. DYNAMICS

Ae. En. 270, 271. Flight Dynamics. (3, 3)

Prerequisites, Math. 64 and Ae. En. 114. Dynamics of a rigid body and applications to airplane dynamics. Generalized coordinates and Lagrange's equations. Vibrations of simple systems. Dynamics of elastically connected masses. Influence, coefficients. Mode shapes and principal oscillations. Transient stresses in an elastic structure. Wing divergence and aileron reversal. Theory of two dimensional oscillating airfoil. Flutter problems. Corrections for finite span. Compressibility effects.

F. GENERAL

AE. EN. 290. SEMINAR.
(Credit in accordance with work outlined by Aerospace Engineering staff). First and second semesters.

AE. EN. 291, 292. SELECTED TOPICS IN AEROSPACE ENGINEERING. (3, 3)
Prerequisite, permission of instructor. Topics of current interest and recent advances in the field.

AE. EN. 399. RESEARCH.
(Credit in accordance with work outlined by Aerospace Engineering staff). First and second semesters. Prerequisite, graduate standing. (Staff.)

AGRICULTURE

For Graduates and Advanced Undergraduates

AGR. 100. INTRODUCTORY AGRICULTURAL BIOMETRICS. (3)
First semester. Two lectures and one laboratory period per week. Introduction to fundamental concepts underlying the applications of biometrical methods to agricultural problems with emphasis on graphical presentation of data, descriptive statistics, chi-square and t-tests, and linear regression and correlation.

For Graduates

AGR. 200. AGRICULTURAL BIOMETRICS. (3)
Second semester. Two lectures and one laboratory period per week. Prerequisite, Agr. 100 or equivalent. A continuation of Agr. 100 with emphasis on analysis of variance and co-variance, multiple and curvilinear regression, sampling, experimental design and miscellaneous statistical techniques as applied to agricultural problems.

AGR. 202, 203. ADVANCED BIOLOGICAL STATISTICS. (2, 2)
First and second semesters. Prerequisite, approval of instructor. An advanced course dealing with specialized experimental designs, sampling techniques and elaborations of standard statistical procedures as applied to the animal and plant sciences.

AGR. 210. EXPERIMENTAL PROCEDURES IN AGRICULTURAL SCIENCES. (3)
First semester. Prerequisite, permission of instructor. Organization of research projects and presentation of experimental results in the field of Agricultural science. Topics included will be: sources of research financing, project outline preparation, formal progress reports, public and industrial supported research programs, and technical and popular presentation of research data.
(Haut.)

AGRICULTURAL ECONOMICS

Professors: Curtis, Beal, Evans (visiting professor), Poffenberger, Smith and Walker.

Associate Professors: Foster, Ishee, McDonald, Moore, Murray, Schermerhorn, Smith, Stevens, Tuthill, Walker, and Wysong.

Assistant Professors: Bender, Cain, Lessley, and Suttor.

For Graduates and Advanced Undergraduates

A.E. 103. Economics of Agricultural Cooperation. (3)

Second semester. A course in the development, expansion and consolidation of the cooperative method of business. Modern business organization and operating principles and practices related to farmer cooperatives are stressed. (Smith.)

A.E. 104. Economics of Agricultural Transportation. (3)

First semester. The course deals with the unique nature of agriculture in broad perspective as it relates to economics of transportation of the products involved. It includes the development of agricultural transportation, effect of legislation and regulation upon this development, and growth of the intercarrier competition. Theories of rate making and classification of carriers are discussed from the standpoint of the effect of transportation costs and methods upon plant and industry location in agriculture. (Smith.)

A.E. 106. Prices of Agricultural Products. (3)

Second semester. An introduction to agricultural price behavior. Emphasis is placed on the use of price information in the decision-making process, the relation of supply and demand in determining agricultural prices, and the relation of prices to grade, time, location and stages of processing in the marketing system. The course includes elementary methods of price analysis, the concept of parity, and the role of price support programs in agricultural decisions. (Bender.)

A.E. 107. Financial Analysis of the Farm Business. (3)

First semester. Application of economic principles to develop criteria for a sound farm business, including credit source and use, preparing and filing income tax returns, methods of appraising farm properties, the summary and analysis of farm records, leading to effective control and profitable operation of the farm business. (Wysong.)

A.E. 108. Farm Management. (3)

Second semester. The organization and operation of the farm business to obtain an income consistent with family resources and objectives. Principles of production economics and other related fields are applied to the individual farm business. Laboratory period will be largely devoted to field trips and other practical exercises. (Ishee.)

A.E. 109. Introduction to Econometrics in Agriculture. (3)

First semester. An introduction to the application of econometric techniques to agricultural problems with emphasis on the assumptions and computational techniques necessary to derive statistical estimates, test hypotheses, and make

predictions with the use of single equation models. Includes linear and non-linear regression models, internal least squares, discriminant analysis and factor analysis. (Bender.)

A.E. 111. Economics of Resource Development. (3)
First semester. Economic, political and institutional factors which influence the use of land resources. Application of elementary economic principles in understanding social conduct concerning the development and use of natural and man-made resources. (Tuthill.)

A.E. 112. Agricultural Policy and Programs. (3)
First semester. A study of public policies and programs related to the problems of agriculture. Description, analysis and appraisal of current politics and programs will be emphasized. (Beal.)

A.E. 114. World Agricultural Production and Trade. (3)
First semester. World production, consumption and trade patterns for agricultural products. International trade theory applied to agricultural products. National influences on international agricultural trade. (Foster.)

A.E. 115. Marketing Animals and Animal Products. (3)
First semester. Principles, functions, methods and channels of marketing animals and animal products including livestock and livestock products, dairy animals and dairy products, and poultry and poultry products. Application of basic principles of economics and marketing in a study of the role of the marketing system and development of measures of performance. (Smith.)

A.E. 116. Marketing Plant Products. (3)
Second semester. Principles, functions, methods and channels of marketing plant products including fruits, vegetables, horticultural specialties, grain and tobacco. Analyses of supply, demand, prices, grading, regulatory activities, and government programs and services. (Staff.)

A.E. 119. Foreign Agricultural Economies. (3)
Second semester. Analysis of the agricultural economy of selected areas of the world. The interrelationships among institutions and values, such as government and religion, and the economics of agricultural organization and production. (Foster.)

A.E. 199. Seminar. (1, 1)
First and second semesters. Students will obtain experience in the selection, preparation and presentation of economic topics and problems which will be subjected to critical analysis. (Wysong.)

For Graduates

A.E. 200. Application of Econometrics in Agriculture. (3)
First semester. Tools for analyzing demand and price behavior of agricultural products. Theories of least squares, estimation of structural economic relations in simultaneous equation systems, identification problems, and non-linear estimation techniques. (Ishee.)

A.E. 201. Advanced Theory and Practice of International Agricultural Trade. (3)

Second semester. Advanced theory, politics and practice in international trade in agricultural products. Includes principal theories of trade and finance, agricultural trade policies of various countries, and the mechanics of how trade is conducted. (Moore.)

A.E. 202. Market Structure in Agriculture. (3)

First semester. This course centers on the concept of market structure analysis, with application of principles developed to agricultural industries. The dimension of market structure is analyzed along with its impact on conduct and performance. Considerable time is spent on policy issues and the application of the antitrust laws to agricultural industries. (Moore.)

A.E. 208. Agricultural Price and Income Policy. (3)

Second semester. The evolution of agricultural policy in the United States, emphasizing the origin and development of governmental programs, and their effects upon agricultural production, prices and income. (Beal.)

A.E. 210. Rural Taxation and Public Functions. (3)

Second semester. Theory and practical problems in rural taxation. Major types of taxes are considered in detail. The tax system as it affects farmers and rural areas will be discussed. Major functional responsibilities of the different levels of governments are studied, with emphasis upon public service to rural areas and equal tax effort for support of equal functional programs. (Walker.)

A.E. 212. Agriculture in World Economic Development. (3)

First semester. Theories and concepts of what makes economic development happen. Approaches and programs for stimulating the transformation from a primitive agricultural economy to an economy of rapidly developing commercial agriculture and industry. Analysis of selected agricultural development programs in Asia, Africa and Latin America. (Foster.)

A.E. 214. Advanced Agricultural Marketing. (3)

Second semester. Advanced study of the complex theoretical, institutional and legal factors governing both domestic and foreign agricultural trade, with particlar attention given to politics and practices affecting cost and price. (Beal.)

A.E. 216. Economics of Agricultural Production. (3)

First semester. Study of the more complex problems involved in the long-range adjustments, organization and operation of farm resources, including the impact of new technology and methods. Applications of the theory of the firm, linear programming, activity analysis and input-output analysis. (Ishee.)

A.E. 218. Agricultural Economics Research Techniques. (3)

First semester. Emphasis is given to philosophy and basic objectives of research in the field of agricultural economics. The course is designed to help students define a research problem and work out logical procedures for executing research in the social sciences. Attention is given to the techniques and tools available to agricultural economists. Research documents in the field will be appraised from the standpoint of procedures and evaluation of the research. (Wysong.)

A.E. 219. Advanced Land Economics. (3)

Second semester. Application of micro and macro economic principles to the analyses of special problems related to land, such as public direction of land use, tenure arrangements, conservation and land reform movements. (Wysong.)

A.E. 220. International Impacts of Selected Agricultural Forces. (3)

Second semester. Selected agricultural forces (such as pressure of population on food supply) and their impacts on the political, social and economic development of the world. (Foster.)

A.E. 300. Special Topics in Agricultural Economics. (3)

First and second semesters. This course is designed to offer students special subject matter in the field of agricultural economics. Subject matter taught in this course will be varied and will depend on the persons available for teaching unique and specialized phases of agricultural economics. The course will be taught by the staff or visiting agricultural economists who may be secured on lectureship or visiting professor basis. (Staff.)

A.E. 301. Special Problems in Agricultural Economics. (1-2) (4 Cr. Max.)

First and second semesters and summer. Intensive study and analysis of specific problems in the field of agricultural economics, which will provide information in depth in areas of special interest to the student. (Staff.)

A.E. 302. Seminar. (1, 1)

First and second semesters. Students will participate through study of problems in the field, reporting to seminar members and defending positions adopted. Outstanding leaders in the field will present ideas for analyses and discussion among class members. Students involved in original research will present progress reports. Class discussion will provide opportunity for constructive criticism and guidance. (Curtis.)

A.E. 399. Research.

First and second semesters and summer. Advanced research in agricultural economics. Credit according to work accomplished. (Staff.)

AGRICULTURAL AND EXTENSION EDUCATION

Professor: Cardozier.

Associate Professor: Smith.

Assistant Professor: Johnson.

The Department of Agricultural and Extension Education offers work leading to the degree of Master of Science. Students may choose either a program on agricultural education or extension education.

Students pursuing either curriculum will be expected to have completed at least one year of experience in the field in which they are studying. They will be expected to have completed at least 16 semester hours of education, except that one year of professional experience in their field of study may be substituted for eight semester hours of the prerequisites. Deficiencies in prerequisites may be made up after being admitted to the Graduate School.

The Department also offers a program leading to the Advanced Graduate Specialist Certificate; it requires 30 credits beyond the master's degree. One may specialize in agricultural education, extension education, rural adult education, or community development.

Department requirements, supplemental to the Graduate School, are available for the guidance of graduate students.

For Graduates and Advanced Undergraduates

R. Ed. 114. Rural Life in Modern Society. (3)

Second semester. Examination of the many aspects of rural life that affect, and are affected by, changes in technical, natural and human resources. Emphasis is placed on the role which diverse organizations, agencies, and institutions play in the education and adjustment of rural people to the demands of modern society. (Staff.)

R. Ed. 150. Extension Education. (2)

Second semester. The Agricultural Extension Service as an educational agency. The history, philosophy, objectives, policy, organization, legislation, and methods used in extension work. (Johnson.)

R. Ed. 160. Extension Communications. (2)

First semester. An introduction to communications in teaching and within an organization; including barriers to communication, the diffusion process, and the application of communications principles person to person, with groups, and through mass media. (Johnson.)

R. Ed. 170, 171. Conservation of Natural Resources. (3,3)

Laboratory fee, $35.00. Designed primarily for teachers. Study of state's natural resources—soil, water, fisheries, wildlife, forests, and minerals—natural resource problems and practices. Extensive field study. First course concentrates on subject matter; second includes methods of teaching conservation. Courses taken concurrently in summer session. (Staff.)

R. Ed. 180, 181. Critique in Rural Education. (1, 1)

Current problems and trends in rural education. (Staff.)

For Graduates

R. Ed. 200. Research Methods in Rural Education. (2-3)

First semester. The scientific method, problem identification, survey of research literature, preparing research plans, design of studies, experimentation, analysis of data and thesis writing. (Cardozier.)

Agricultural and Extension Education

R. Ed. 201. Rural Community Analysis. (3)

First semester. Analysis of structure and function of rural society and application of social understandings to educational processes. (Smith.)

R. Ed. 204. Developing Rural Leadership. (2-3)

First semester. Theories of leadership are emphasized. Techniques of identifying formal and informal leaders and the development of rural lay leaders. (Staff.)

R. Ed. 207, 208. Special Topics in Rural Education. (2, 2)

Prerequisite, permission of instructor. (Staff.)

R. Ed. 209. Rural Adult Education. (2)

Second semester. Principles of adult education applied to rural groups. Understanding adult motivation, ability and behavior. Effective methods of planning, organizing and conducting rural adult education programs. (Staff.)

R. Ed. 215. Supervision of Student Teaching. (1)

Summer session. Identification of experiences and activities in an effective student teaching program, responsibilities and duties of supervising teachers, and evaluation of student teaching. (Cardozier.)

R. Ed. 217. Program Planning and Evaluation in Agricultural Education. (2-3)

Second semester. Analysis of community agricultural education needs, selection and organization of course content, criteria and procedures for evaluating programs. (Staff.)

R. Ed. 225. Program Development in Extension Education. (2)

Prerequisite, R. Ed. 150 or equivalent. Principles and procedures of program planning and development in extension education. (Johnson.)

R. Ed. 240. Agricultural College Instruction. (1)

(Cardozier.)

R. Ed. 301. Special Problems in Rural Education. (1-3)

Prerequisite, approval of staff. (Staff.)

R. Ed. 302. Seminar in Rural Education. (1, 1)

Second semester. Problems in the organization, administration, and supervision of the several agencies of rural education. Investigations, papers, and reports. (Cardozier.)

R. Ed. 399. Research. (1-6)

(Staff.)

AGRICULTURAL ENGINEERING

Professors: Green and Burkhardt.

Associate Professors: Gienger, Harris and Winn.

Assistant Professor: Matthews.

The Department of Agricultural Engineering offers a graduate course of study leading to the degree of Master of Science. The student may pursue major work in agricultural power and machinery, soil and water conservation engineering, agricultural structures or electric power and processing. A thesis based upon original research work is required. An employee of a nearby institution may submit a thesis based on research work at the institution under the direction of and with prior approval by the Department.

Laboratory facilities are available for work in each area of specialization and, in cooperation with other departments, ample areas for field tests and studies are available.

For Graduates and Advanced Undergraduates

Agr. Engr. 113. Mechanics of Food Processing. (4)

Second semester. Three lectures and one laboratory a week. Laboratory optional. Prerequisite, Physics 1 or 10. A study of problems in power transmission, hydraulics, electricity, thermodynamics, refrigeration, instruments and controls, materials handling, and analysis of time and motion as related to the processing of agricultural commodities. (Matthews.)

Agr. Engr. 123. Agricultural Production Equipment. (3)

First semester. Two lectures and one laboratory per week. Prerequisite, Agr. Engr. 1. Principles of operation and functions of power and machinery units as related to tillage; metering devices; cutting, conveying and separating units; and control mechanisms. Principles of internal combustion engines and power unit components. (Matthews.)

Agr. Engr. 124. Agricultural Materials Handling and Environmental Control. (3)

Second semester. Two lectures and one laboratory per week. Prerequisite, Agr. Engr. 1. Characteristics of construction materials and details of agricultural structures. Fundamentals of electricity, electrical circuits, and electrical controls. Materials handling and environmental requirements of farm products and animals. (Matthews.)

Agr. Engr. 143. Agricultural Power and Machinery Analysis. (4)

First semester. Three lectures and one laboratory per week. Prerequisites, Agr. Engr. 1, E.S. 21, and M. E. 1. Analysis of power units and equipment used for agricultural production with emphasis on functional design requirements. Fundamentals of power transmission, principles of internal combustion engines and force analysis. (Harris.)

Agr. Engr. 144. Design of Operational Systems for Agriculture. (3)

Second semester. Two lectures and one laboratory per week. Prerequisite, Math.

21 and Phys. 21. Principles and engineering requirements of agricultural environmental control. Included are studies of controlling heat and moisture produced by animals and crops, static loading of farm structures and electrical components as related to environments and materials handling. (Harris.)

AGR. ENGR. 145. SOIL AND WATER CONSERVATION ENGINEERING. (2)
Second semester. Two lectures per week. Prerequisites, C. E. 90 and M. E. 102. Applications of engineering and soil sciences in erosion control, drainage, irrigation and watershed management. Principles of agricultural hydrology and design of water control and conveyance systems. (Green.)

AGR. ENGR. 198. SPECIAL PROBLEMS IN FARM MECHANICS. (1-3)
First and second semesters. Prerequisite, approval of Department. Problems assigned in proportion to credit. (Gienger.)

For Graduates

AGR. ENGR. 201. SPECIAL TOPICS IN AGRICULTURAL ENGINEERING. (3)
First and second semesters. Two lectures and one laboratory period per week. Timely topics in specialized areas of agricultural engineering will be selected. For example, Instrumentation for Agricultural Engineering Research. (Staff.)

AGR. ENGR. 301. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING. (1-6)
First and second semester and summer school. Work assigned in proportion to amount of credit. (Staff.)

AGR. ENG. 302. SEMINAR. (1)
First and second semesters. Prerequisite, permission of instructor. (Harris.)

AGR. ENG. 399. RESEARCH. (1-6)
Credit according to work accomplished.
(Staff.)

AGRONOMY

CROPS, SOILS, AND GEOLOGY

Professors: MILLER, ROTHGEB AND STREET.

Associate Professors: AXLEY, CLARK, DECKER, KRESGE AND STRICKLING.

Assistant Professors: BEYER, COLBY, DEAL, FANNING AND FERNOW.

The Department of Agronomy offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in the crops division or in the soils division of the Department. A thesis based on original research is required for each degree. Ample laboratory and greenhouse facilities for graduate work are available on the campus. The Plant Research Farm, the Forage Research Farm, and the Tobacco Experiment Farm offer adequate nearby research facilities. Many projects of the Department are

conducted in cooperation with the Agricultural Research Service of the United States Department of Agriculture with headquarters located three miles from the campus.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Agronomy.

CROPS

For Graduates and Advanced Undergraduates

AGRON. 103. CROP BREEDING. (2)

First semester, alternate years. (Offered 1966-67.) Prerequisite, Bot. 117 or Zool. 6. Principles and methods of breeding annual self and cross-pollinated plants and perennial forage species. (Beyer.)

AGRON. 104. TOBACCO PRODUCTION. (2)

Second semester. Three lectures a week. Prerequisite, Bot. 1. A study of the history, adaptation, distribution, culture, and improvement of various types of tobacco, with special emphasis on problems in Maryland tobacco production. Physical and chemical factors associated with yield and quality of tobacco will be stressed. (Street.)

AGRON. 107. CEREAL CROP PRODUCTION. (3)

First semester, alternate years. (Offered 1966-67.) Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the principles and practice of corn, wheat, oats, barley, rye, and soybean production. (Rothgeb.)

AGRON. 108. FORAGE CROP PRODUCTION. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the production and management of grasses and legumes for quality hay, silage and pasture. (Decker.)

AGRON. 109. TURF MANAGEMENT. (2)

First semester, alternate years. (Offered 1967-68.) Two lectures a week. Prerequisite, Bot. 1. A study of principles and practices in management of turf for lawns, athletic fields, playgrounds, airfields, and highway planting. (Deal.)

AGRON. 151. CROPPING SYSTEMS. (2)

Second semester. Two lectures a week. Prerequisite, Agron. 1 or equivalent. The co-ordination of information from various courses in the development of balanced cropping systems, appropriate to different objectives in various areas of the state and nation. (Clark.)

AGRON. 152. SEED PRODUCTION AND DISTRIBUTION. (2)

Second semester, alternate years. (Offered 1966-67.) One lecture and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of seed production, processing, and distribution; federal and state seed control programs; seed laboratory analyses; release of new varieties and maintenance of foundation seed stocks. (Newcomer.)

AGRON. 154. WEED CONTROL. (3)

First semester, alternate years. (Offered 1967-68.) Two lectures and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of the use of cultural practices and chemical herbicides in the control of weeds. (Colby.)

For Graduates

AGRON. 201. ADVANCED CROP BREEDING. (2)

First semester, alternate years. (Offered 1967-68.) Prerequisite, Agron. 103 or equivalent. Genetic, cytogenetic, and statistical theories underlying methods of plant breeding. A study of quantitative inheritance, heterosis, heritability, interspecific and intergeneric hybridization, polyploidy, sterility mechanisms, inbreeding and outbreeding, and other topics as related to plant breeding. (Beyer.)

AGRON. 204. TECHNIC IN FIELD CROP RESEARCH. (2)

Second semester, alternate years. (Offered 1966-67.) Field plot technique, application of statistical analysis to agronomic data, and preparation of the research project. (LeClerg.)

AGRON. 205. ADVANCED TOBACCO PRODUCTION. (2)

First semester, alternate years. (Offered 1967-68.) Two lectures a week. Prerequisite, permission of instructor. A study of the structural adaptation and chemical response of tobacco to environmental variations. Emphasis will be placed on the alkaloids and other unique components. (Street.)

AGRON. 207. ADVANCED FORAGE CROPS. (2)

First semester, alternate years. (Offered 1966-1967.) Two lectures a week. Prerequisites, Bot. 101, Chem. 31, or equivalent, or permission of instructor. A fundamental study of physiological and ecological responses of grasses and legumes to environmental factors, including fertilizer elements, soil moisture, soil temperature, air temperature, humidity, length of day, quality and intensity of light, wind movement, and defoliation practices. Relationship of these factors to life history, production, chemical and botanical composition, quality, and persistence of forages will be considered. (Decker.)

AGRON. 208. RESEARCH METHODS. (2)

Second semester. Prerequisite, permission of staff. Development of research viewpoint by detailed study and report on crop research of the Maryland Experiment Station or review of literature on specific phases of a problem. (Staff.)

AGRON. S210. CROPPING SYSTEMS. (1)

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents. It deals with outstanding problems and the latest developments in the field. (Staff.)

SOILS

For Graduates and Advanced Undergraduates

AGRON. S110. SOIL MANAGEMENT. (1)

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents dealing with factors involved in

management of soils in general and of Maryland soils in particular. Emphasis is placed on methods of maintaining and improving chemical, physical, and biological characteristics of soils. (Strickling.)

AGRON. 111. SOIL FERTILITY PRINCIPLES. (3)

First semester, alternate years. (Offered 1966-67.) Three lectures a week. Prerequisite, Agron. 10. A study of the chemical, physical, and biological characteristics of soils that are important in growing crops. Soil deficiencies of physical, chemical, or biological nature and their correction by the use of lime, fertilizers, and rotations are discussed and illustrated. (Strickling.)

AGRON. 112. COMMERCIAL FERTILIZERS. (3)

Second semester. Three lectures a week. Prerequisite, Agron. 10 or permission of instructor. A study of the manufacturing of commercial fertilizers and their use in soils for efficient crop production. (Axley.)

AGRON. 113. SOIL CONSERVATION. (3)

First semester, alternate years. (Offered 1966-67.) Two lectures and one laboratory period a week. Prerequisite, Agron. 10 or permission of instructor. A study of the importance and causes of soil erosion, and methods of soil erosion control. Special emphasis is placed on farm planning for soil conservation. The laboratory period will be largely devoted to field trips. (Staff.)

AGRON. 114. SOIL CLASSIFICATION AND GEOGRAPHY. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisite, Agron. 10, or permission of instructor. A study of the genesis, morphology, classification and geographic distribution of soils. The broad principles governing soil formation are explained. Attention is given to the influence of geographic factors on the development and use of soils in the United States and other parts of the world. The laboratory periods will be largely devoted to field trips and to a study of soil maps of various countries. (Fanning.)

AGRON. 116. SOIL CHEMISTRY. (3)

First semester. alternate years. (Offered 1966-67.) One lecture and two laboratory periods a week. Prerequisite, Agron. 10, or permission of instructor. A study of the chemical composition of soils; cation and anion exchange; acid, alkaline and saline soil conditions; and soil fixation of plant nutrients. Chemical methods of soil analysis will be studied with emphasis on their relation to fertilizer requirements. (Axley.)

AGRON. 117. SOIL PHYSICS. (3)

First semester, alternate years. (Offered 1967-68.) Two lectures and one laboratory period a week. Prerequisites. Agron. 10 and a course in physics, or permission of instructor. A study of physical properties of soil with special emphasis on relationship to soil productivity. (Strickling.)

AGRON. 119. SOIL MINERALOGY. (4)

First semester, alternate years. (Offered 1967-68.) Two lectures and two laboratory periods a week. Prerequisite, permission of instructor. A study of the fundamental laws and forms of crystal symmetry and essentials of crystal structure; structure, occurrence, association and uses of minerals, determination of minerals by means of their morphological, chemical and physical properties. Particular attention is given to soil-forming minerals. Laboratory periods will be devoted to a systematic study of about 75 minerals. (Siegrist.)

For Graduates

AGRON. 250. ADVANCED SOIL MINERALOGY. (3)

First semester, alternate years. (Offered 1966-67.) Three lectures a week. Prerequisites, Agron. 10, Agron. 119 and permission of instructor. A study of the structure, physical-chemical characteristics and identification methods of soil minerals, particularly clay minerals, and their relationship to soil genesis and productivity. (Fanning.)

AGRON. 251. ADVANCED METHODS OF SOIL INVESTIGATION. (3)

First semester, alternate years. (Offered 1967-68.) Three lectures a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry. (Axley.)

AGRON. 252. ADVANCED SOIL PHYSICS. (3)

Second semester, alternate years. (Offered 1967-68.) Two lectures and one laboratory period a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of physical properties of soils. (Strickling.)

AGRON. 253. ADVANCED SOIL CHEMISTRY. (3)

Second semester, alternate years. (Offered 1966-67.) One lecture and two laboratory periods a week. Prerequisites, Agron. 10 and permission of instructor. A continuation of Agron. 116 with emphasis on soil chemistry of minor elements necessary for plant growth. (Axley.)

For Graduates

AGRON. 260. RECENT ADVANCES IN AGRONOMY. (2-4)

First semester. Two hours each year. Total credit four hours. Prerequisite, permission of instructor. A study of recent advances in agronomy research. (Staff.)

AGRON. 302. AGRONOMY SEMINAR. (1, 1)

First and second semesters. Total credit toward Master of Science degree, 2; toward Ph.D. degree, 6. Prerequisite, premission of instructor. (Staff.)

AGRON. 399. RESEARCH.

First and second semesters. Credit according to work done. (Staff.)

GEOLOGY

For Graduates and Advanced Undergraduates

GEOL. 119. SOIL MINERALOGY. (4)

First semester, alternate years. (Offered 1967-68.) Two lectures and two laboratory periods a week. Prerequisite, permission of instructor. A study of the fundamental laws and forms of crystal symmetry and essentials of crystal structure: structure, occurrence, association and uses of minerals, determination of minerals by means of their morphological, chemical and physical properties. Particular attention is given to soil-forming minerals. Laboratory periods will be devoted to a systematic study of about 75 minerals.

(Siegrist.)

ANIMAL SCIENCE

Professors: Foster and Green.

Associate Professors: Buric, Leffel and Young.

The Department of Animal Science offers work leading to the degrees of Master of Science and Doctor of Philosophy. Course work and thesis problems are offered in the areas of animal breeding, nutrition, and livestock production.

Departmental requirements have been formulated for the information and guidance of graduate students. Copies of these requirements are available from the Department of Animal Science.

For Graduates and Advanced Undergraduates

An. Sc. 109. Fundamentals of Nutrition. (3)
See Poultry Science for description. (Combs.)

An. Sc. 110. Applied Animal Nutrition. (3)
See Dairy Science for description. (Vandersall.)

An. Sc. 116. Anatomy of Domestic Animals. (3)
First semester. One lecture and two laboratory periods per week. A systematic comparative study of the pig, ruminants and fowl with special emphasis of those systems important in animal production. Prerequisite, Zoology 1. (Brown.)

An. Sc. 117. Introduction to Diseases of Animals. (3)
Second semester. Two lectures and one laboratory period per week. This course gives basic instruction in the nature of disease: including causation, immunity, methods of diagnosis, economic importance, public health aspects and prevention and control of the common diseases of sheep, cattle, swine, horses and poultry. Prerequisite, Micro. 1 and Zoology 1. (Brown.)

An. Sc. 118. Wildlife Management. (3)
Second semester. Two lectures and one laboratory. An introduction to the interrelationships of game birds and animals with their environment, population economics and the principles of wildlife management. (Flyger.)

An. Sc. 120. Advanced Livestock Judging. (2)
First semester. Two laboratory periods per week. Prerequisites, An. Sc. 22 and permission of instructor. An advanced course in the selection and judging of purebred and commercial meat animals. The most adept students enrolled in the course are chosen to represent the University of Maryland in Intercollegiate Livestock Judging Contests. (Buric.)

An. Sc. 121. Meat and Meat Products. (3)
Second semester. Two lectures and one laboratory period per week. Prerequisite, An. Sc. 20. Registration limited to 14 students. A course designed to give the basic facts about meat as a food and the factors influencing acceptability, marketing and quality of fresh meats. It includes comparisons of characteristics of live animals with their carcasses, grading and evaluating carcasses as well as wholesale cuts, and the distribution and merchandising of

the nation's meat supply. Laboratory periods are conducted in packing houses, meat distribution centers, and retail outlets. (Buric.)

An. Sc. 122. Livestock Management. (3)
First semester. One lecture and two laboratory periods per week. Prerequisite, An. Sc. 109. Applications of various phases of animal science to the management and production of beef cattle, sheep and swine. (Foster.)

An. Sc. 123. Livestock Management. (3)
Second semester. One lecture and two laboratory periods per week. Prerequisite, An. Sc. 122. Application of various phases of animal science to the management and production of beef cattle, sheep and swine. (Leffel.)

An. Sc. 130. Principles of Animal Breeding. (3)
Second semester. Three lectures per week. Prerequisites, Zoology 6 or Bot. 117, An. Sc. 122 or 123 or An. Sc. 22. Graduate credit (1-3 hours) allowed with permission of instructor. Aspects of Animal breeding, heredity, variation, selection, systems of breeding and pedigree study are considered. (Green.)

An. Sc. S131. Special Topics in Animal Science. (1)
Prerequisite, permission of instructor. Summer session only. This course is designed primarily for teachers of vocational agriculture and Extension Service personnel. One primary topic to be selected mutually by the instructor and students, will be presented each session.

An. Sc. 140. Physiology of Mammalian Reproduction. (2)
See Dairy Science for description. (Williams.)

An. Sc. 141. Physiology of Milk Secretion. (2)
See Dairy Science for description. (Williams.)

An. Sc. 142. Dairy Cattle Breeding. (3)
See Dairy science for description. (Plowman.)

An. Sc. S143. Advanced Dairy Production. (1)
See Dairy Science for description. (Staff.)

An. Sc. 160. Technology of Market Eggs and Poultry. (3)
See Poultry Science listing for description. (Helbacka.)

An. Sc. 161. Poultry Genetics. (3)
See Poultry Science for description. (Wilcox.)

An. Sc. 162. Avian Physiology. (2)
See Poultry Science for description. (Wilcox.)

An. Sc. S163. Poultry Breeding and Feeding. (1)
See Poultry Science for description. (Combs, Wilcox.)

An. Sc. S164. Poultry Products and Marketing. (1)
See Poultry Science for description. (Helbacka.)

An. Sc. 165. Physiology of Hatchability. (1)
See Poultry Science for description. (Shaffner.)

An. Sc. 170. Poultry Hygiene. (3)
See Veterinary Science for description. (DeVolt.)

An. Sc. 171. Avian Anatomy. (3)
See Veterinary Science for description. (DeVolt.)

An. Sc. 198. Special Problems in Animal Science. (1-2) (4 Cr. Max.)
First and second semester. Prerequisite, approval of staff. Work assigned in proportion to amount of credit. A course designed for advanced undergraduates in which specific problems relating to animal science will be assigned. (Staff.)

An. Sc. 199. Seminar. (1)
Second semester. Prerequisite, permission of staff. Presentation and discussion of current literature and research work in animal science. (Staff.)

(Attention is called to A.E. 117, Economics of Marketing Eggs and Poultry (3) [See Agricultural Economics]; and Fd. Sc. 125, Meat and Meat Processing (3) [See Horticulture].)

For Graduates

An. Sc. 200. Electron Microscopy. (2)
See Veterinary Science for description. (Mohanty.)

An. Sc. 220. Advanced Breeding. (2)
Second semester, alternate years. Two lectures a week. Prerequisites, An. Sc. 130 or equivalent, and Biological Statistics. This course deals with the more technical phases of heredity and variation, selection indices, breeding systems, and inheritance in farm animals. (Green.)

An. Sc. 221. Energy and Protein Nutrition. (3)
Second semester. Prerequisites, Chem. 31 and 33, or equivalent, An. Sc. 109 or permission of Instructor. Three lectures per week. A study of animal energetics and the basic descriptions of animals relative to the requirements for energy and protein. Literature dealing with nutrition research techniques and energy and protein utilization and requirements is surveyed.
(Leffel and Combs.)

An. Sc. 240. Ruminant Nutrition. (2)
See Dairy Science for description. (Vandersall.)

An. Sc. 241. Research Methods. (3)
See Dairy Science for description. (Stewart.)

An. Sc. 242. Experimental Mammalian Surgery I. (2)
See Dairy Science for description. (Stewart.)

An. Sc. 243. Experimental Mammalian Surgery II. (3)
See Dairy Science for description. (Stewart.)

An. Sc. 261. Physiology of Reproduction. (3)
See Poultry Science for description. (Shaffner.)

AN. SC. 262. POULTRY LITERATURE. (1-4)
See Poultry Science for description. (Staff.)

AN. SC. 263S. POULTRY NUTRITION LABORATORY. (2)
See Poultry Science for description. (Creek.)

AN. SC. 264. VITAMINS. (2)
See Poultry Science for description. (Combs.)

AN. SC. 265. MINERAL METABOLISM. (2)
See Poultry Science for description. (Creek.)

AN. SC. 301. SPECIAL PROBLEMS IN ANIMAL SCIENCE. (1-2) (4 Cr. Max.)
First and second semesters. Work assigned in proportion to amount of credit. Prerequisite, approval of staff. Problems will be assigned which relate specifically to the character of work the student is pursuing. (Staff.)

AN. SC. 302. SEMINAR. (1) (5 Cr. Max.)
First and second semesters. Students are required to prepare papers, based upon current scientific publications relating to Animal Science, or upon their research work, for presentation before and discussion by the class; (1) Recent advances; (2) Nutrition; (3) Physiology; (4) Biochemistry. (Staff.)

AN. SC. 399. RESEARCH (1-12)
First and second semesters. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of animal science, carrying the same to completion, and report the results in the form of a thesis. (Staff.)

ART

Professors: LEVITINE, LEMBACH AND MARIL.

Associate Professor: DE LEIRIS.

Assistant Professors: DENNY, GROSSMAN, GRUBAR, JAMIESON, LONGLEY, O'CONNELL AND STITES.

The Department of Art offers a graduate program of study leading to the degree of Master of Arts. Two types of majors are offered: Art History and Studio. The major in Art History is committed to the advanced study and scholarly interpretation of existing works of art, from the prehistoric era to our times, while the Studio major stresses the student's direct participation in the creation of works of art. Both disciplines, rooted in the concept of art as a humanistic experience, share an essential common aim: the development of the student's aesthetic sensitivity, understanding and knowledge.

A limited number of Fellowships and Graduate Assistantships are available in Art. Interested students should apply to the Department of Art.

HISTORY OF ART MAJOR: For admission to graduate study in Art History, in addition to the approved undergraduate degree, or its equivalent, special Departmental requirements must be met. For the master's degree an adequate reading knowledge of French, German or other approved language will be expected. A written comprehensive examination will be administered to each student before qualifying for the final examination. A thesis is required.

STUDIO MAJOR: For admission to graduate study in Studio Art, an undergraduate degree with an art major from an accredited college or university, or its equivalent, is required. In addition, special Departmental requirements must be met. A portfolio should be submitted to the Department along with application for admission. Candidate for the master's degree will be required to pass a written comprehensive examination, and submit a thesis or an original creative project in painting, drawing, sculpture or print making.

For information on work leading to the degrees of Master of Arts or Master of Education in Art Education, the student is referred to the section devoted to the Department of Education in this catalogue.

For Graduates and Advanced Undergraduates

ART 117. PAINTING II. (3)

Six hours per week. Prerequisites, Art 17, 26. Original compositions based upon nature, figure and still life, supplemented by expressive painting. Choice of media. Different sections of course may be taken for credit.

117-a. Oil painting and related media. (Maril, Chieffo.)

117-b. Watercolor and casein. (Grossman.)

117-c. Plastic media, such as encaustic and polymer tempera. (Jamieson.)

117-d. Mural painting. The use of contemporary synthetic media. (Jamieson.)

ART 118. SCULPTURE I. (3)

Six hours per week. Prerequisite, Art 26. (For student majoring in Art History, by permission of Department.) Volumes, masses, and planes, based on the use of plastic earths. Simple armature construction and methods of casting. (Freeny.)

ART 119. PRINTMAKING I. (3)

Six hours per week. Prerequisite, Art 26. (For student majoring in Art History, by permission of Department.) Basic printmaking technique in relief, intaglio, and planographic media. (O'Connell.)

ART 126. DRAWING III. (3)

Six hours per week. Prerequisite, Art 26. Emphasis on understanding organic form, as it is related to study from the human figure and to pictorial composition. (Jamieson, Chieffo.)

ART 127. PAINTING III. (3)

Six hours per week. Prerequisite, Art. 117. Creative painting for advanced students. Problems require a knowledge of pictorial structure. Development of personal direction. Choice of media. (Grossman, Maril.)

ART 128. SCULPTURE II. (3)

Six hours per week. Prerequisite, Art 118. Different sections of course may be taken for credit.

128-a. Nature as a point of reference with potentiality of developing ideas into organic and architectural forms. (Freeny.)

128-b. May be taken after 128-a. Problems involving plastic earths and other material capable of being modeled or cast. Choice of individual style encouraged. (Freeny.)

ART 129. PRINTMAKING II. (3)

Six hours per week. Prerequisite, Art 119. One print media including extensive study of color processes. Individually structured problems.

(O'Connell.)

ART 137. PAINTING IV. (3)

Six hours per week. Prerequisite, Art 127. Creative painting. Emphasis on personal direction and self-criticism. Group seminars.

(Grossman, Jamieson, Maril.)

ART 138. SCULPTURE III. (3)

Six hours per week. Prerequisite, Art 128. Problems and techniques of newer concepts, utilizing various materials, such as: plastics and metals. Technical aspects of welding stressed. (Freeny.)

ART 139. PRINTMAKING III. (3)

Six hour per week. Prerequisite, Art 129.

139-a. Contemporary experimental techniques of one print medium with group discussions. (O'Connell.)

139-b. Continuation of 139-a. May be taken for credit after 139-a.

(O'Connell.)

ART 160, 161. CLASSICAL ART. (3, 3)

Architecture, sculpture and painting in the classical cultures. First semester will stress Greece; second semester, Rome. (Staff.)

ART 162, 163. ART OF THE EAST. (3, 3)

Architecture, sculpture and painting. First semester will stress India; second semester, China and Japan. (Staff.)

ART 164. EARLY CHRISTIAN AND BYZANTINE ART. (3)

Architecture, sculpture, painting, and mosaic of early Christian Rome, the near East, and the Byzantine Empire. (Staff.)

ART 166, 167. MEDIEVAL ART. (3, 3)

Architecture, sculpture and painting in the Middle Ages. First semester will stress Romanesque; second semester, the Gothic period. (Denny.)

ART 168, 169. RENAISSANCE ART IN ITALY. (3, 3)
Architecture, sculpture and painting from 1400 to the High Renaissance in the 16th century. (Hayum.)

ART 170. NORTHERN EUROPEAN PAINTING IN THE 15TH AND 16TH CENTURIES. (3)
Painting in Flanders and related northern European areas, from Van Eyck to Brueghel and Durer. (Denny.)

ART 172, 173. EUROPEAN BAROQUE ART. (3, 3)
Architecture, sculpture and painting of the major European centers in the 17th century. (de Leiris.)

ART 174, 175. FRENCH PAINTING. (3, 3)
French painting from the 15th through the 18th century, from Fouquet to David. (Levitine.)

ART 176, 177. 19TH CENTURY EUROPEAN ART. (3, 3)
Architecture, sculpture and painting in European Art from Neo-Classicism to Impressionism. (de Leiris.)

ART 178, 179. 20TH CENTURY ART. (3,3)
Architecture, sculpture and painting from the late 18th century to our day. (O'Connor.)

ART 192, 193. DIRECTED STUDIES IN STUDIO ART. (2 or 3, 2 or 3)
For advanced students, by permission of Department Head. Course may be repeated for credit if content differs. (Staff.)

ART 194, 195. DIRECTED STUDIES IN ART HISTORY. (2 or 3, 2 or 3)
For advanced students, by permission of Department Head. Course may be repeated for credit if content differs. (Staff.)

For Graduates

The requirements of students will determine which courses will be offered.

ART 200, 201. PAINTING. (3, 3)
Specific projects to be developed. Conferences arranged. (Grossman, Jamieson, Maril.)

ART 202, 203. PAINTING. (3, 3)
Individual projects growing in complexity. Seminars. (Grossman, Jamieson, Maril.)

ART 211. PRINTMAKING. (3)
Advanced problems. Relief process. (O'Connell.)

ART 212. PRINTMAKING. (3)
Advanced problems. Intaglio process. (O'Connell.)

ART 213. PRINTMAKING. (3)
Advanced problems. Lithographic process. (O'Connell.)

Art 214. Seminar in Printmaking. (3)
(O'Connell.)

Art 221, 222. Experimentation in Sculpture. (3, 3)
Independent research stressed. (Freeny.)

Art 223. Materials and Techniques in Sculpture. (3)
For advanced students. Methods of armature building, casting, and the use of a variety of stone, wood, metal, and plastic materials. (Freeny.)

Art 224. Sculpture—Casting and Foundry. (3)
The traditional methods of plaster casting and the more complicated types involving metal. *Cire perdue,* sand-casting and newer methods, such as cold metal process. (Freeny.)

Art 226. Drawing. (3)
Sustained treatment of a theme chosen by student. Wide variety of media. (Jamieson.)

Art 227. Drawing. (3)
Traditional materials and methods including Oriental, Sumi ink drawing and techniques of Classical European masters. (Jamieson.)

Art 228. Drawing. (3)
Detailed anatomical study of the human figure and preparation of large scale mural compositions. (Jamieson.)

Art 229. Drawing and Painting. (3)
Preparation and execution of a wall decoration. (Jamieson.)

Art 240, 241. Advanced Problems in Art Education. (3, 3)
An integrated series of problems determined by the student's professional needs. (Lembach.)

Art 250. American Colonial Art. (3)
The arts during the exploration period and Colonial development. (Grubar.)

Art 255. Seminar in 19th Century American Art. (3)
Problems in architecture, sculpture and painting from the end of the Colonial period until 1860. (Grubar.)

Art 261. Seminar in Romanticism. (3)
Problems derived from the development of Romantic Art during the 18th and 19th centuries. (Levitine.)

Art 263. Seminar in 19th Century European Art. (3)
Problems derived from the period starting with David and ending with Cezanne. (de Leiris.)

Art 266. Seminar in Contemporary Art. (3)
Problems of Western art from 1900 to the present. (O'Connor.)

Art 268. Seminar in Literary Sources of Art History. (3)
Art historical sources from Pliny to Malraux. (Levitine.)

ART 292, 293. DIRECTED GRADUATE STUDIES IN STUDIO ART. (3, 3)
For advanced graduate students by permission of Head of Department. Course may be repeated for credit if content differs. (Staff.)

ART 294, 295. DIRECTED GRADUATE STUDIES IN ART HISTORY. (3, 3)
For advanced graduate students, by permission of Head of Department. Course may be repeated for credit if content differs. (Staff.)

ART 399. RESEARCH. (1-6)

ASTRONOMY

Professors: LASTER, WESTERHOUT (DIRECTOR) AND OPIK.

Part-time Professor: MUSEN.

Associate Professors: ERICKSON, V. P. SMITH AND VAN WIJK.

Visiting Associate Professor: KOMESAROFF.

Assistant Professor: BELL.

Visiting Part-time Lecturer: CHOU.

The Department of Physics and Astronomy is offering a program of study leading to the degrees of M.S. and Ph.D. in Astronomy.

It is normally expected that the following subjects should have been studied previous to admission to graduate work: general physics, heat, intermediate mechanics, optics, electricity and magnetism, modern physics, differential and integral calculus, and advanced calculus. A student may be admitted without one of these courses, but he should plan to make up the deficiency as soon as possible, either by including such a course as a part of his graduate program or by independent study.

No formal undergraduate course work in astronomy is required. However, an entering student should have a working knowledge of the basic facts of astronomy such as is obtainable from one of the many elementary textbooks. A more advanced knowledge of astronomy will of course enable a student to progress considerably more rapidly during the first year of graduate work. It is recommended that those new students who have little knowledge of astronomy spend part of the summer brushing up on their elementary astronomy.

PRELIMINARY EXAMINATION. Astronomy students will take a preliminary examination, preferably before they enter the Graduate School. A satisfactory score is required before the student is admitted to take the Ph.D. Qualifying Examination or admitted to candidacy for the M.S. The preliminary examination required is the Graduate Record Examination, Advanced Test in Physics, given several times per year by the Educational Testing Service, Princeton, N. J. The student must pass the examination within 15 months after entering the Department.

The examination tests the adequacy of the student's undergraduate training in physics. deemed necessary for almost all fields of astronomy.

THE PH.D. QUALIFYING EXAMINATION is offered each year in September and has to be taken each year by all Astronomy students working toward a Ph.D. who have passed the Preliminary Examination and completed one year of graduate study. The normal time limit for passing for full-time students is three years, in special cases extended to four, for part-time students it is six years. The time limit for obtaining the Ph.D. is 7 years for full-time and 8 years for part-time students. For the M.S., these time limits are 5 and 6 years, respectively.

STUDY PROGRAM. All candidates must obtain three credits of Astr. 100 or Astr. 102, preferably both, for an advanced degree. This requirement may be waived if the student has previous experience. All students should take at least two credits of Astr. 230, Astronomy Seminar. All full-time graduate students are expected to take or audit Astr. 230 each term. No other Astronomy courses are specifically required, but candidates for the Ph.D. should expect to take at least 12 credits of Astronomy courses at the 200-level, exclusive of Astr. 230, in order to pass the Qualifying Examination.

Many of the advanced Astronomy courses will be offered once every other year, which should be taken into account when individual study programs are considered. Students are urged to acquire a broad background in all fields of Astronomy in addition to their field of specialization.

Astronomy majors will ordinarily take a minor in Physics, where general Physics courses are counted toward fulfillment of the minor requirements. If appropriate for the particular program of study, other areas such as Engineering, Mathematics and Chemistry may be chosen as partial fulfillment of the minor requirements.

A typical list of minor courses for a M.S. candidate might consist of Phys. 200, 201, Theoretical Dynamics (3, 3), and Mathematics 162, Vector Analysis (3), and/or Physics 212, Introduction to Quantum Mechanics (4).

A Ph.D. candidate might take the following courses towards a minor in Physics:

Physics 119, Modern Physics (3),

Physics 144, 145, Methods of Theoretical Physics (4, 4)

Physics 200, 201, Theoretical Dynamics (3, 3)

Physics 204, Electrodynamics (3)

Physics 212, Introduction to Quantum Mechanics (4)

These lists of minor courses can be greatly varied depending on the student's preparation and interests, but Phys. 200 and 201 should always be included unless the student has a particularly strong undergraduate background in theoretical dynamics.

The Department also offers M.S. and Ph.D. degrees in Astrophysics. The study program for these degrees can be carefully adjusted to give the optimum proportion of Physics and Astronomy courses suitable for some particular borderline field of study. Students majoring in Astrophysics will have the option of taking the qualifying examination in either Physics or Astronomy. Special departmental approval of the study program must be obtained unless the program meets all requirements of either the Physics or Astronomy degree.

For more information, especially for Physics courses related to Astronomy, see the section on Physics. All correspondence should be addressed to Astronomy Program, Department of Physics and Astronomy.

For Graduates and Advanced Undergraduates

Astronomy 100. Observational Astronomy. (3)

Second semester. Two lectures and two hours of laboratory work per week. Prerequisite, Math. 21 and at least 12 credits of introductory physics and astronomy courses. Introduction to the methods of astronomical photometry and spectroscopy. Laboratory work consists of measuring photoelectric records and spectroscopic plates and observations with the 20″ telescope. This course or its equivalent will be required of students who wish to do optical observational work in Astronomy 399. Laboratory fee, $10.00. (van Wijk.)

Astronomy 101. Introduction to Galactic Research. (3)

First semester. Three lectures per week. Prerequisite, Math. 21 and at least 12 credits of introductory physics and astronomy courses. Stellar motions, methods of galactic research, study of our own and nearby galaxies, clusters of stars, evolution: statistical parallax, distance determination, galactic rotation and structure, high velocity stars. (van Wijk.)

Astronomy 102. Introduction to Astrophysics. (3)

Second semester. Three lectures per week. Prerequisite, previous or concurrent enrollment in Physics 119 or consent of instructor. Spectroscopy, structure of atmospheres of the sun and other stars. Observational data and curves of growth. Chemical composition. (Bell.)

Astronomy 110. Introduction to Radio Astronomy. (3)

Three lectures per week. Prerequisite, Math. 21 and at least 12 credits of introductory physics and astronomy courses. Principles of radio telescopes and receivers, with demonstration. Basic observational techniques. Characteristics of extra-terrestrial radio noise, sources of radio emission, the 21-cm line. Distribution of radio emission over the sky, and the resulting distribution in space, our own Galaxy and external galaxies. Radio emission from the sun. (Westerhout.)

Astronomy 124. Introduction to Celestial Mechanics. (3)

Spring semester. Prerequisite, Physics 127 or consent of the instructor. Newton's Law of Gravitation; two-body problem and its integrals; Kepler's laws; elements of an orbit, determination of the position and velocity vectors from elements and vice versa. Determination of an orbit from observations: Gaussian

and Laplacian methods. Orbit correction methods. Perturbations in co-ordinates elements. Computation of satellite orbits, including perturbations. (Musen.)

Astronomy 150. Special Problems in Astronomy.

(Credit according to work done)

Prerequisites. major in astronomy or physics and consent of one of the members of the astronomy staff. Research or special study. Laboratory fee, $10.00 per credit hour when appropriate. (Staff.)

Astronomy 190. Honors Seminar.

(Credit according to work done)

Each semester. Enrollment is limited to students admitted to the Honors Program in astronomy. (Staff.)

For Graduates

Astronomy 200. Dynamics of Stellar Systems. (3)

First semester. Three lectures per week. Prerequisite, Physics 200 or Astronomy 101. Study of the structure and evolution of dynamical systems encountered in astronomy. Stellar encounters viewed as a two-body problem, statistical treatment of encounters. Study of dynamical problems in connection with star clusters, ellipsoidal galaxies, nuclei of galaxies, high-velocity stars. (van Wijk.)

Astronomy 202. Stellar Interiors. (3)

Three lectures per week. Prerequisites. Math. 114 and Physics 119 or consent of instructor. A study of stellar structure and evolution. This course will consider the question of energy transfer and generation in the interior of a star, the structure of stars, including problems of turbulence, determination of chemical compositin. non-homogeneous stars, evolution of both young and old stars. pulsating stars, novae. (Bell.)

Astronomy 203. Stellar Atmospheres. (3)

Three lectures per week. Prerequisite, Physics 212 or consent of the instructor. Observational methods, line formation, curve of growth, equation of transfer, stars with large envelopes. variable stars, novae, magnetic fields in stars. (Bell.)

Astronomy 204. Physics of the Solar System. (3)

Three lectures per week. Prerequisite, Physics 119. A survey of the problems of the interplanetary space, comets and meteors, planetary structure and atmospheres, physics of the earth's upper atmosphere, motions of particles in the earth's magnetic field. (Opik.)

Astronomy 210. Galactic Radio Astronomy. (3)

Three lectures per week. Prerequisites. Physics 119, Astronomy 101, 110 or consent of the instructor. Theory and observations of the continuum and 21-cm line emission from the Galaxy. Galactic structure derived from radio observations. comparison with optical data. The rotation of the Galaxy. The galactic halo, the nucleus, proposed mechanisms. (Westerhout.)

Astronomy 212. Physics of the Solar Envelope. (3)

Three lectures per week. Prerequisites, Physics 119, Astronomy 102 and 110 or consent of the instructor. A detailed study of the radio emission from the sun. Physics of solar phenomena, such as solar flares, structure of the Corona, etc. (Erickson, v. P. Smith.)

Astronomy 214. Interstellar Matter. (3)

Three lectures per week. Prerequisites, previous or concurrent enrollment in Physics 212, Astronomy 101 or Astronomy 102 or consent of instructor. A study of the physical properties of interstellar gas and dust. This course will include diffuse nebulae, regions of ionized hydrogen, regions of neutral hydrogen, the problems of interstellar dust and perhaps planetary nebulae, molecules. (Staff.)

Astronomy 230. Seminar. (1)

Seminars on various topics in advanced astronomy are held each semester, with the contents varied each year. One credit for each seminar each semester. (v. P. Smith.)

Astronomy 248, 249. Special Topics in Modern Astronomy

Credit according to work done each semester. Prerequisite, consent of instructor. These courses will be given by specialists in various fields of modern astronomy, partly staff members, partly visiting professors or part-time lecturers. They will cover subjects such as: cosmology, discrete radio sources, magnetohydrodynamics in astronomy, the H. R. diagram, stellar evolution, external galaxies, galactic structure, chemistry of the interstellar medium, advanced celestial mechanics, astrometry, etc. (Staff.)

Astronomy 399. Research.

Credit according to work done each semester. Laboratory fee $10.00 per credit hour. Prerequisite: an approval application for admission to candidacy or special permission of the Department of Physics and Astronomy.

There are weekly colloquia by staff, astronomers from the Washington area, and visiting astronomers, usually on topics related to their own work.

AMERICAN STUDIES

Committee on American Studies:

Associate Professor: Beall, director of the program.

Professor: Schlaretski.

Visiting Professor: Main.

Lecturer: Lounsbury.

The American Studies Program offers work leading to both the degrees of Master of Arts and Doctor of Philosophy. The Departments of English, History, Art and Philosophy join to offer integrated plans of study. In his class work the student will emphasize the offerings of any one of these

departments; either English or History must be included within his field of emphasis. For the lists of courses from which his program is to be developed. he is to see principally the listings of the four departments just mentioned. The Director of the program will serve as the student's adviser in consultation with the chairman of the department in the field of the student's special interest.

For Graduates and Advanced Undergraduates

Amer. Stud. 127, 128. Culture and the Arts in America. (3, 3)
First and second semesters. A study of American institutions, the intellectual and esthetic climate from the colonial period to the present. (Beall.)

Amer. Stud. 137, 138. Conference Course in American Studies (3, 3)
First and second semesters. An examination of the nature of the American character in historical perspective as seen through the eyes of native and foreign writers from the Puritan oligarchy to the present day. (Lounsbury.)

For Graduates

Amer. Stud. 201, 202. Seminar in American Studies. (3, 3)
First and second semesters. (Beall, Lounsbury.)

Amer. Stud. 399. Thesis Research. (1-6)
Arranged. (Staff.)

BOTANY

Professors: Krauss, Bamford, Gauch, Norton (emeritus), D. T. Morgan, Weaver and Sisler.

Associate Professors: Brown, Rappleye, Paterson, Kantzes, O. Morgan, Galloway, Krusberg, Lockard and Mans.

Assistant Professors: Klarman, Terborgh, Harrison, Bean and Patterson.

The Department of Botany offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in plant physiology, plant pathology, plant ecology, plant taxonomy, nematology, cytogenetics, or plant anatomy. Inasmuch as a thesis based on original research is required for each degree, a qualified student may be allowed to pursue a problem of his own choosing, or choose some area of research in progress since the Department is devoted to a study of basic agricultural problems as well as projects of a more fundamental nature. An individual employed at a nearby institution may submit a thesis based on his research work at the institution under the direction of, and subject to prior approval by, a member of the faculty.

Laboratory facilities are available for research in each division, and there are ample greenhouses and plot space available on the campus or adjacent University farm land.

In addition to the normal requirements of the Graduate School, one must possess a reading knowledge of one language, either French, German, Latin, or Russian, before the Master of Science degree is granted; two foreign languages are required for the Ph.D. degree.

PLANT PHYSIOLOGY

For Graduates and Advanced Undergraduates

Bot. 101. Plant Physiology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Bot. 1 and general chemistry. Laboratory fee, $6.00. A survey of the general physiological activities of plants. (Krauss, Lockard.)

Bot. 102. Plant Ecology. (2)

Second semester. Prerequisite, Bot. 1. A study of the different plant successions and vegetational climaxes and their correlation with the climatic, soil, and biotic factors of the environment. (Brown.)

Bot. 103. Plant Ecology Laboratory. (1)

Second semester. One three-hour laboratory period a week. Prerequisite, Bot. 102 or equivalent, or concurrent registration therein. Laboratory fee, $6.00. The application of field and other methods to the qualitative and quantitative study of vegetation and environmental factors. (Brown, Terborgh.)

For Graduates

Bot. 200. Plant Biochemistry. (2)

First semester. (Not offered 1967-1968). Prerequisites, Bot. 101 and elementary organic chemistry, or equivalent. A study of the important substances in the composition of the plant body and the chemical changes occurring therein. (Galloway.)

Bot. 201. Plant Biochemistry Laboratory. (2)

First semester. (Not offered 1967-1968.) Two laboratory periods a week. Prerequisite, Bot. 200 or concurrent registration therein. Laboratory fee, $10.00. Application of apparatus and techniques to the study of the chemistry of plant materials. (Galloway, Gauch.)

Bot. 202. Plant Biophysics. (2)

Second semester. (Not offered 1966-1967.) Prerequisites, Bot. 1 and introductory physics, or equivalent. An advanced course dealing with the operation of physical phenomena in plant life processes. (Galloway.)

Bot. 203. Biophysical Methods. (2)

Second semester. (Not offered 1966-1967.) Two laboratory periods a week. Laboratory course to accompany Bot. 202. Laboratory fee, $10.00. (Galloway, Gauch.)

Bot. 204. Growth and Development. (2)

First semester. (Not offered 1966-1967.) Prerequisite, 12 semester hours of plant science. A study of current developments in the mathematical treatment of growth and the effects of radiation, plant hormones. photoperiodism, and internal biochemical balance during the development of the plant. (Krauss.)

Bot. 205. Mineral Nutrition of Plants. (2)

Second semester. (Not offered 1967-1968.) Reports on current literature are presented and discussed in connection with recent advances in the mineral nutrition of plants. (Patterson.)

Bot. 209. Physiology of Algae. (2)

Second semester. Prerequisite, Bot. 201, the equivalent in allied fields or permission of instructor. Laboratory fee, $10.00. A study of the physiology and comparative biochemistry of the algae. Laboratory techniques and recent advances in algal nutrition, photosynthesis, and growth will be reviewed. (Krauss.)

Bot. 210. Physiology of Algae-Laboratory. (1)

Second semester. One laboratory period a week. Prerequisites, previous or concurrent enrollment in Bot. 209, and permission of instructor. Laboratory fee, $10.00. Special laboratory techniques involved in the study of algal nutrition. (Krauss.)

Bot. 219. Advanced Plant Ecology. (2)

First semester. (Not offered 1967-1968.) Prerequisite, Bot. 102 or equivalent and permission of instructor. Laboratory fee, $10.00. Discussion of current developments in ecology, with emphasis on quantitative and radioecological techniques and the energy exchanges in ecological systems. Field trips and problems will be arranged. (Brown, Terborgh.)

PLANT MORPHOLOGY, CYTOLOGY, AND TAXONOMY

For Graduates and Advanced Undergraduates

Bot. 111. Plant Anatomy. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Bot. 110 or equivalent. Laboratory fee, $5.00. The origin and development of the organs and tissue systems in the vascular plants. (Rappleye.)

Bot. 113. Plant Geography. (2)

First semester. Prerequisite, Bot 1 or equivalent. A study of plant distribution throughout the world and the factors generally associated with such distribution. (Brown.)

Bot. 115. Structure of Economic Plants. (3)

Second semester. (Not offered 1966-1967.) One lecture and two laboratory periods a week. Laboratory fee, $5.00. A detailed microscopic study of the anatomy of the chief fruit and vegetable crops. (Rappleye.)

Bot. 116. History and Philosophy of Botany. (1)

Second semester. (Not offered 1967-1968.) Prerequisite, 20 semester hours credit in Biological Sciences, including Bot. 1 or equivalent. Discussion of the development of ideas and knowledge about plants, leading to a survey of contemporary work in botanical science. (Bamford.)

Bot. 117. General Plant Genetics. (2)

Second semester. Prerequisite, Bot. 1 or equivalent. The basic principles of plant genetics are presented; the mechanics of transmission of the hereditary factors in relation to the life cycle of seed plants, the genetics of specialized organs and tissues, spontaneous and induced mutations of basic and economic significance, gene action, genetic maps, the fundamentals of polyploidy, and genetics in relation to methods of plant breeding are the topics considered.
(Mans, D. T. Morgan.)

Bot. 136. Plants and Mankind. (2)

First semester. A survey of the plants which are utilized by man, the diversity of such utilization, and their historic and economic significance. (Rappleye.)

Bot. 151S. Teaching Methods in Botany. (2)

Summer session. Four two-hour laboratory and demonstration periods a week for eight weeks. Prerequisite, Bot. 1, or equivalent. Laboratory fee, $5.00. A study of the biological principles of the common plants, and demonstrations, projects, and visual aids suitable for teaching in primary and secondary schools.
(Paterson.)

Bot. 153. Field Botany and Taxonomy. (2)

Summer session. Prerequisite, Bot. 1 or general biology. Laboratory fee, $5.00. The identification of trees, shrubs, and herbs, emphasizing the native plants of Maryland. Manuals, keys, and other techniques will be used. Numerous short field trips will be taken. Each student will make an individual collection.
(Brown.)

Bot. 161. Systematic Botany. (2)

First semester. (Not offered 1966-1967.) Two two-hour laboratory periods a week. Prerequisite, Bot. 11 or equivalent. Laboratory fee, $6.00. An advanced study of the principles of systematic botany. Laboratory practice with difficult plant families including grasses, sedges, legumes, and composites. Field trips arranged.
(Brown.)

For Graduates

Bot. 211. Cytology. (4)

First semester. (Not offered 1966-1967.) Two lectures and two laboratory periods a week. Prerequisite, introductory genetics. Laboratory fee, $10.00. A detailed study of the chromosomes in mitosis and meiosis, and the relation of these to current theories of heredity and evolution. (D. T. Morgan.)

Bot. 212. Plant Morphology. (3)

Second semester. (Not offered 1967-1968.) One lecture and two laboratory periods a week. Prerequisites, Bot. 11, Bot. 111, or equivalent. Laboratory fee, $5.00. A comparative study of the morphology of the flowering plants, with special reference to the phylogeny and development of floral organs.
(Rappleye.)

Bot. 215. Plant Cytogenetics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, introductory genetics. Laboratory fee, $10.00. An advanced study of the current status of plant genetics, particularly gene mutations and their relation to chromosome changes in corn and other favorable genetic materials.
(D. T. Morgan, Mans.)

PLANT PATHOLOGY

For Graduates and Advanced Undergraduates

Bot. 122. Research Methods in Plant Pathology. (2)

First semester. Two laboratory periods a week. Prerequisite, Bot. 20, or equivalent. Laboratory fee, $5.00. Advanced training in the basic research techniques and methods of plant pathology. (Klarman.)

Bot. 123. Diseases of Ornamental Plants. (2)

Second semester. (Not offered 1966-1967.) Prerequisite, Bot. 20, or equivalent. Symptoms, control measures, and other pertinent information concerning the diseases which affect important ornamental plants grown in the eastern states. (Klarman.)

Bot. 124. Diseases of Tobacco and Agronomic Crops. (2)

First semester. (Not offered 1967-1968.) Prerequisite, Bot. 20, or equivalent. The symptoms and control of the diseases of tobacco, forage crops, and cereal grains. (O. D. Morgan.)

Bot. 125. Diseases of Fruit Crops. (2)

First semester. (Not offered 1966-1967.) Prerequisite, Bot. 20, or equivalent. Symptoms and control of the diseases affecting fruit production in the eastern United States. (Weaver.)

Bot. 126. Diseases of Vegetable Crops. (2)

Second semester. (Not Offered 1967-1968.) Prerequisite, Bot. 20, or equivalent. The recognition and control of diseases affecting the production of important vegetable crops grown in the eastern United States. (Kantzes.)

Bot. 128. Mycology. (4)

Second semester. (Not offered 1967-1968.) Two lectures and two laboratory periods a week. Prerequisite, Bot. 2, or equivalent. Laboratory fee, $6.00. An introductory study of the morphology, classification, life histories, and economics of the fungi. (Paterson.)

Bot. 152S. Field Plant Pathology. (1)

Summer session. Daily lecture for three weeks. Prerequisite, Bot. 20 or equivalent. Laboratory fee, $5.00. A course for county agents and teachers of vocational agriculture. Discussion and demonstration of the important diseases in Maryland crops. (Staff.)

For Graduates

Bot. 221. Plant Virology. (3)

First semester. (Not offered 1967-1968.) Two lectures and one laboratory period a week. Prerequisites, Bot. 20 and Bot. 101, or equivalent. Laboratory fee, $10.00. Consideration of the biological, biochemical, and biophysical aspects of plant viruses and virus diseases. (Sisler.)

Bot. 223. Physiology of Fungi. (2)

Second semester. (Not offered 1966-1967.) Prerequisites, Organic Chemistry and Bot. 101 or the equivalent in bacterial or animal physiology. A study of various aspects of fungal metabolism, nutrition, biochemical transformations, fungal products and mechanism of fungicidal action. (Sisler.)

Bot. 224. Physiology of Fungi Laboratory. (1)
Second semester. (Not offered 1966-1967.) One laboratory period a week. Prerequisite, Bot. 223 or concurrent registration therein. Laboratory fee, $10.00. Application of equipment and techniques in the study of fungal physiology. (Sisler.)

Bot. 226. Plant Disease Control. (3)
First semester. (Not offered 1966-1967.) Prerequisite, Bot. 20, or equivalent. An advanced course dealing with the theory and practices of plant disease control. (Staff.)

Bot. 241. Plant Nematology. (4)
Second semester. (Not offered 1966-67.) Two lectures and two laboratory periods a week. Prerequisite, Bot. 20 or permission of instructor. Laboratory fee, $10.00. The study of plant-parasitic nematodes, their morphology, anatomy, taxonomy, genetics, physiology, ecology, host-parasite relations and control. Recent advances in this field will be emphasized. (Krusberg.)

Bot. 301. Special Problems in Botany. (1 to 3)
First or second semester. Credit according to time scheduled and organization of course. Maximum credit toward an advanced degree for the individual student at the discretion of the Department. This course may be organized as a lecture series on a specialized advanced topic, or may consist partly, or entirely, of experimental procedures. It may be taught by visiting lectures, or by resident staff members. Problems or topics may be in: 1—Physiology; 2—Ecology; 3—Pathology; 4—Mycology; 5—Nematology; 6—Cytology; 7—Cytogenetics; 8—Morphology; 9—Anatomy; or 10—Taxonomy. (Staff.)

Bot. 302. Seminar in Botany. (1)
First and second semester. Prerequisite, permission of the instructor. Discussion of special topics and current literature in all phases of botany. (Staff.)

Bot. 399. Research. (*Credit according to work done.*)
A minimum of 6 credit hours is required for the M.S. degree, and an additional minimum of 12 hours is required for the Ph.D. degree. Students must be qualified to pursue with profit the research to be undertaken. (Staff.)

BUSINESS ADMINISTRATION

Professors: Taff, Clemens, Cook, Fisher, Gentry, Nelson, Sweeney, Wright, Patrick and Calhoun.

Associate Professors: Anderson, Ashmen, Dawson and Spivey.

Assistant Professors: Bartlett, Brunner, Carroll, Clickner, Culbertson, Daiker, Edelson, Hermanson, Hille, Himes, Nash, Olson, Paine, Ryans, Schellenberger, Smerk, Spychalski, Suelflow, Tosi, and Durant.

The degree of Master of Business Administration is conferred on those students who satisfactorily complete the requirements which are set forth in the section of this catalog entitled, "Requirements for the Degree of Master of Business Administration."

For Graduates and Advanced Undergraduates

B. A. 100. Office Operations and Management. (3)

Deals with the principles of scientific management as they apply to the examination, improvement, installation, and operation of the most effective paperwork methods and systems that a given organization can use to achieve its objectives. Procedure flow analysis and form design for control of paperwork; process, work distribution, and layout charts, distribution of authority and responsibility for office activities are among the areas considered. (Patrick.)

B. A. 101. Electronic Data Processing. (3)

Prerequisite, junior standing, Math. 11 or the equivalent. Laboratory fee, $10.00. The electronic digital computer and its use as a tool in processing data. The course includes the following areas: (1) organization of data processing systems, (2) environmental aspects of computer systems, (3) fundamentals of programming using a common problem-oriented language, and (4) management control problems and potentials inherent in mechanized data processing systems. (Patrick.)

B. A. 102. Electronic Data Processing Applications. (3)

Prerequisite, B.A. 101. Laboratory fee, $10.00. Intensive study of computer applications using a problem-oriented language. Introduction of computer methods for the solution of business problems. Laboratory exercises in programming and development of computer techniques. (Durant.)

B. A. 103. Introduction to Systems Analysis. (3)

Prerequisite, B.A. 102. Laboratory fee, $10.00 (effective September, 1964). Math. 15 or the equivalent. The use of the computer in management and the operation of business. The course includes the following areas: (1) The principles of system analysis, (2) recent applications and innovations of the systems concept, (3) design and implementation of computer systems, including such techniques as mathematical programming, simulation, business games, and network analysis, (4) laboratory use of a digital computer in the application of these techniques. (Staff.)

B. A. 110, 111. Intermediate Accounting. (3, 3)

First and second semesters. Prerequisite, B.A. 21. A comprehensive study of the theory and problems of valuation of assets, application of funds, corporation accounts and statements, and the interpretation of accounting statements. (Wright.)

B. A. 112. Records Management. (2)

First and second semesters. Prerequisite, junior standing. Laboratory fee, $7.50. Specific management methods and techniques that have proved valuable in the creation, use, maintenance, protection and disposition of records are studied. (Staff.)

B. A. 118. Governmental Accounting. (3)

Prerequisite, B.A. 21. The content of this course covers the scope and functions of governmental accounting. It considers the principles generally applicable to all forms and types of governmental bodies and a basic procedure adaptable to all governments. (Wright.)

B. A. 119. Budgeting and Control. (3)
Prerequisite, B.A. 21. The use of financial data in controlling an enterprise. Budgetary formulation, execution and appraisal. The use of accounting in managerial decision making. (Olson.)

B. A. 120. Accounting Systems. (3)
Prerequisite, B.A. 20. A study of the factors involved in the design and installation of accounting systems: the organization, volume and types of transactions, charts of accounts, accounting manuals, the reporting system. Offered only in Summer School. (Himes.)

B. A. 121. Cost Accounting. (4)
Prerequisite, B.A. 21. A study of the fundamental procedures of cost accounting, including those for job orders, process and standard cost accounting systems. (Olson.)

B. A. 122. Auditing Theory and Practice. (3)
First semester. Prerequisite, B.A. 111. A study of the principles and problems of auditing and application of accounting principles to the preparation of audit working papers and reports. (Hermanson.)

B. A. 123. Income Tax Accounting. (4)
Prerequisite, B.A. 21. A study of the important provisions of the Federal Tax Law, using illustrative examples, selected questions and problems, and the preparation of returns. (Edelson.)

B. A. 124. Advanced Accounting. (3)
Prerequisite, B.A. 111. Advanced Accounting theory applied to specialized problems in partnerships, ventures, consignments, installment sales, insurance, statement of affairs, receiver's accounts, realization and liquidation reports, and application of mathematics to accounting problems. Offered only in Summer School. (Himes.)

B. A. 125. C.P.A. Problems. (3)
Second semester. Prerequisite, B.A. 111, or consent of instructor. A study of the nature, form and content of C.P.A. examinations by means of the preparation of solutions to, and an analysis of, a large sample of C.P.A. problems covering the various accounting fields. (Daiker.)

B. A. 126. Advanced Accounting. (3)
Prerequisite, B.A. 111. Home office and branch accounting, parent and subsidiary accounting, and foreign exchange. (Hermanson.)

B. A. 127. Advanced Auditing Theory and Practice. (3)
Prerequisite, B.A. 122. Advanced auditing theory and practice and report writing. (Wright.)

B. A. 128. Advanced Cost Accounting. (2)
Prerequisite, B.A. 121. A continuation of basic cost accounting with special emphasis on process costs, standard costs, joint costs and by-product costs. (Olson.)

B. A. 130. Business Statistics I. (3)

Prerequisite, junior standing. Required for graduation. Laboratory fee, $10.00 (effective September, 1964). An introductory course. Emphasis is placed upon statistical inference. Topics covered include statistical observation, frequency distributions, averages, measures of variability, elementary probability, sampling distributions, problems of estimation, simple tests of hypothesis, index numbers, times series, graphical and tabular presentation. Selected applications of the techniques are drawn from economics, industrial management, marketing and accounting. (Anderson.)

B. A. 131. Business Statistics II. (3)

Second semester. Prerequisite, B.A 130. Laboratory fee, $10.00 (effective September, 1964). Review of elementary probability. Population distributions. Sampling distributions; binomial, Poisson, normal, "t", chi-square and F. Estimates and tests of hypotheses concerning the mean, variance and other parameters. Introduction to analysis of variance, linear regression, and correlation. (Nelson.)

B. A. 132. Sample Surveys in Business and Economics. (3)

Prerequisite, B.A. 130. Laboratory fee, $10.00. (effective September, 1964). A general course in scientific sample survey techniques. Review of elementary probability, characteristics of good estimators, errors of observation, simple random sampling, stratified random sampling, cluster sampling, comparison of various sample designs, cost functions, examples of actual survey practices. (Nelson.)

B. A. 134. Statistical Quality Control. (3)

Second semester. Prerequisite, B.A. 130. Laboratory fee, $10.00. (effective September, 1964). Statistical fundamentals; theory, construction and use of control charts; acceptance sampling by attributes and variables; work sampling and other industrial applications of statistics. (Anderson.)

B. A. 135. Statistical Analysis and Forecasting. (3)

Alternates with B.A. 132. Prerequisite, B.A. 130. Laboratory fee, $10.00. (effective September, 1964). Classical time series analysis, trend, periodic and irregular components, seasonal adjustment, growth curves, recent developments in time series analysis, techniques of forecasting and quantities as labor force, capital formation, demand and sales. (Anderson.)

B. A. 140. Business Finance. (3)

Prerequisite, B.A. 21. This course deals with principles and practices involved in the organization, financing, and rehabilitation of business enterprises; the various types of securities and their use in raising funds, apportioning income, risk, and control; intercorporate relations; and new developments. Emphasis on solution of problems of financial policy faced by management. (Himes.)

B. A. 141. Security Analysis. (3)

Prerequisite, B.A. 140. A study of the principles and methods used in the analysis, selection, and management of investments; investment programs, sources of investment information, security price movements, government, real estate, public utility, railroad, and industrial securities. (Fisher.)

B. A. 143. CREDIT MANAGEMENT. (3)

Prerequisite, B.A. 140. A study of the nature of credit and the principles applicable to its extension and redemption for mercantile and consumer purposes; sources of credit information and analysis of credit reports; the organization and management of a credit department for effective control. Recent developments and effective legal remedies available. (Fisher.)

B. A. 148. ADVANCED FINANCIAL MANAGEMENT. (3)

Prerequisite, B.A. 140. An advanced course in finance. Emphasis is placed upon the techniques employed by executives in their application of financial management practice to selected problems and cases. Critical classroom analysis is brought to bear upon actual methods and techniques used by business enterprises. (Fisher.)

B. A. 149. MARKETING PRINCIPLES AND ORGANIZATION. (3)

Prerequisite, Econ. 32 or 37. This is an introductory course in the field of marketing. Its purpose is to give a general understanding and appreciation of the forces operating, institutions employed, and methods followed in marketing agricultural products, natural products, services, and manufactured goods. (Ryans.)

B. A. 150. MARKETING MANAGEMENT. (3)

Prerequisite, B.A. 149. A study of the work of the marketing division in a going organization. The work of developing organizations and procedures for the control of marketing activities are surveyed. The emphasis throughout the course is placed on the determination of policies, methods, and practices for the effective marketing of various forms of manufactured products. (Brunner.)

B. A. 151. ADVERTISING. (3)

Prerequisite, B.A. 149. A study of the role of advertising in the American economy; the impact of advertising on our economic and social life, the methods and techniques currently applied by advertising practitioners, the role of the newspaper, magazine, and other media in the development of an advertising campaign, modern research methods to improve the effectiveness of advertising, and the organization of the advertising business. (Ashmen.)

B. A. 153. PURCHASING MANAGEMENT. (3)

Second semester. Prerequisite, B.A. 149. Determining the proper sources, quality and quantity of supplies, and methods of testing quality; price policies, price forcasting, forward buying, bidding and negotiation; budgets and standards of achievement. Attention is given to government purchasing and methods and procedures used in their procurement. (Spivey.)

B. A. 154. RETAIL MANAGEMENT. (3)

First semester. Prerequisites, B.A. 20 and B.A. 149. Retail store organization, location, layout and store policy; pricing policies, price lines, brands, credit policies, records as a guide to buying; purchasing methods; supervision of selling; training and supervision of retail sales force; and administrative problems. (Cook.)

B. A. 156. MARKETING RESEARCH METHODS. (3)

Second semester. Prerequisites, B.A. 130 and B.A. 149. This course is intended to develop skill in the use of scientific methods in the acquisition, analysis and interpretation of marketing data. It covers the specialized fields of marketing research, the planning of survey projects, sample design, tabulation procedure and report preparation. (Brunner.)

B. A. 157. International Marketing. (3)

Prerequisite, B.A. 149. Functions of various exporting agencies; documents and procedures used in exporting and importing transactions. Methods of procuring goods in foreign countries; financing of import shipments; clearing through the customs districts; and distribution of goods in the United States. (Baker.)

B. A. 158. Advertising Management. (3)

Second semester. Prerequisite, B.A. 151. This course is concerned with the way in which business firms use advertising as a part of their marketing program. The case study methods is used to present advertising problems taken from actual business practice. Cases studied illustrate problems in demand stimulation, media selection, advertising research, etc. (Gentry.)

B. A. 160. Personnel Management I. (3)

This course deals with the problems of directing and supervising employees, under modern industrial conditions. Two phases of personnel administration are stressed, the application of scientific management and the importance of human relations in this field. (Carroll.)

B. A. 161. Personnel Management II. (3)

Prerequisite or Corequisite, B.A. 160. Job evaluation and merit rating and other personnel management techniques generally employed in business. (Nash.)

B. A. 163. Labor Relations. (3)

A study of the development and methods of organized groups in industry with reference to the settlement of labor disputes. An economic and legal analysis of labor union and employer association activities, arbitration, mediation. and conciliation; collective bargaining, trade agreements, strikes, boycotts, lockouts, company unions, employee representation, and injunctions. (Carroll.)

B. A. 164. Labor Legislation and Court Decisions. (3)

Case method analysis of the modern law of industrial relations. Cases include the decisions of administrative agencies, courts and arbitration tribunals. (Carroll.)

B. A. 165. Advanced Production Management. (3)

Prerequisite, B.A. 169. A study of typical problems encountered by the factory manager. The objective is to develop the ability to analyze and solve problems in management control of production and in the formulation of production policies. Among the topics covered are plant location, production planning and control, methods analysis and time study. (Spivey.)

B. A. 166. Business Communications. (3)

First and second semesters. Prerequisite, junior standing. A systematic study of the principles of effective written communications in business. The fundamental aim is to develop the ability to write clear, correct, concise, and persuasive business letters and reports.

B. A. 167. Operations Research I. (3)

The philosophy, methods, and objectives of operations research. Basic methods are examined and their application to functional areas of business are covered. (Schellenberger)

B. A. 168. Management and Organization Theory. (3)

The historical development of management and organization theory, nature of

the management process and functions and its future development. The role of the manager as an organizer and director, the communication process, goals and responsibilities. (Tosi.)

B. A. 169. Production Management. (3)

Studies the operation of a manufacturing enterprise, concentrating on the economies of production. Introduces a grounding in analytical method early so that the broad problem areas of system design, operation, and control can be based upon the analytical method. (Spivey.)

B. A. 170. Principles of Transportation. (3)

Prerequisite, Econ. 32 or 37. A general course covering the five fields of transportation, their development, service and regulation. (Hille.)

B. A. 171. Traffic and Physical Distribution Management. (3)

Prerequisite, junior standing. Examines the management aspects of the business firm in moving their raw materials and finished goods through traffic, warehousing, industrial packaging, material handling, and inventory. A systematic examination of the trade-off possibilities and management alternatives to minimize cost of product flow and maximizing customer service is covered. (Taff.)

B. A. 172. Motor Transportation. (3)

First semester. Prerequisite, B.A. 170. The development and scope of the motor carrier industry, different types of carriers, economics of motor transportation, services available, federal regulation, highway users, highway barriers. (Hille.)

B. A. 173. Water Transportation. (3)

Prerequisite, B.A. 170. Water carriers of all types, development and types of services, trade routes, inland waterways, company organization, the American Merchant Marine as a factor in national activity. (Hille.)

B. A. 174. Commercial Air Transportation. (3)

Prerequisite, B.A. 170. The air transportation system of the United States; airways, airports, airlines. Federal regulation of air transportation. Problems and services of commercial air transportation; economics, equipment, operations, financing, selling of passenger and cargo services. Air mail development and services. (Bartlett.)

B. A. 175. Advanced Transportation Problems. (3)

Prerequisite, B.A. 170. A critical examination of current government transportation policy and proposed solutions. Urban and intercity managerial transport problems are also considered. (Suelflow.)

B. A. 176. Urban Transport and Urban Development. (3)

An analysis of the role of urban transportation in present and future urban development. The interaction of transport pricing and service, urban planning, institutional restraints, and public land uses, is studied. (Spychalski.)

B. A. 180. Business Law. (3)

First and second semesters. Legal aspects of business relationships, contracts, negotiable instruments, agency, partnerships, corporations, real and personal property, and sales. (Dawson.)

B. A. 181. Business Law. (3)

Second semesters. Legal aspects of business relationships, contracts, negotiable instruments, agency partnerships, corporations, real and personal property, and sales. (Dawson.)

B. A. 182. Advanced Business Law. (3)

Designed primarily for C.P.A. candidates. Legal aspects of wills, insurance, torts and bankruptcy. Offered only in Summer School. (Dawson.)

B. A. 184. Public Utilities. (3)

Prerequisites, Econ. 32 or 37. Using the regulated industries as specific examples attention is focused on broad and general problems in such diverse fields as constitutional law, administrative law, public administration, government control of business, advanced economic theory, accounting, valuation and depreciation, taxation, finance, engineering and management.

(Clemens, Suelflow.)

B. A. 189. Business and Government. (3)

Prerequisites, Econ. 32 or 37. A study of the role of government in modern economic life. Social control of business as a remedy for the abuses of business enterprise arising from the decline of competition. Criteria of and limitations on government regulation of private enterprise. (Culbertson.)

B. A. 190. Risk Management. (3)

Designed to acquaint the student with the nature and significance of risk in business enterprise. The problems relating to both pure and speculative risk in business are considered; and methods of solution involving risk assumption, transfer, reduction, and the use of insurance are analyzed as aids in management decision making. (Clickner.)

B. A. 191. Principles of Risk and Insurance. (3)

Emphasizes the use of insurance in resolving problems involving personal and business risks. Life, accident and health, fire and casualty, automobile, and marine insurance are examined as means of dealing with these risks. The theory and legal aspects of insurance are considered, as well as the quantitative measurement of risk. (Clickner.)

B. A. 195. Real Estate Principles. (3)

First semester. This course covers the nature and uses of real estate, real estate as a business, basic legal principles, construction problems and home ownership, city planning, and control ownership of real estate. (Clickner.)

B. A. 196. Urban Land Management. (3)

Covers the managerial and decision making aspects of urban land and property. Included are such subjects as land use and valuation matters. (Clickner.)

B. A. 198. Structure and Operations of Industries. (3)

Prerequisite, senior standing. The impact of technology and production policies on the economic, financial, marketing, and locational policies of representative industries. A background course for students in industrial and financial management, business economics, general business, and related areas.

(Clemens, Culbertson.)

B. A. 199. BUSINESS POLICIES. (3)

Prerequisite, senior standing. A case study course in which the aim is to have the student apply both what he has learned of general management principles and their specialized functional applications to the overall management function in the enterprise. (Schellenberger.)

For Graduates

B. A. 210. ADVANCED ACCOUNTING THEORY. (3)

(Olson.)

B. A. 220. MANAGERIAL ACCOUNTING. (3)

M.B.A. candidates must take B.A. 220 or B.A. 240. (Hermanson.)

B. A. 221, 222. SEMINAR IN ACCOUNTING. (1-6)

(Wright.)

B. A. 226. ACCOUNTING SYSTEMS. (3)

(Olson.)

B. A. 228. RESEARCH IN ACCOUNTING. (1-6)

(Hermanson.)

B. A. 229. MANAGEMENT PLANNING AND CONTROL. (1-6)

(Tosi.)

B. A. 230. ADVANCED BUSINESS STATISTICS. (3)

Prerequisite, B.A. 130 or consent of instructor. Laboratory fee, $10.00 (effective September, 1964). Bayesian decision processes and other statistical methods applicable to the operations of the business firm and the analysis of the economy. Methodological topics include a consideration of utility, expected values, estimation of probabilities, opportunity loss and cost of uncertainty, sampling sequential decision procedures and selected topics from classical statistics. Applications are made to the problems of inventory control, production, investment, and other business functions. (Nelson.)

B. A. 231. THEORY OF SURVEY DESIGN. (3)

Prerequisite, B.A. 131 or B.A. 132, or consent of instructor. Lab fee, $10.00. Theory of sampling from finite populations developed for various types of survey designs. Equi-probability selection methods. Unequal probabilities of selection. Consideration of the characteristics of particular types of estimators as well as cost functions in developing optimum designs. (Nelson.)

B. A. 234. MANAGERIAL ANALYSIS. I. (3)

Required of M.B.A. candidates. The utilization of the scientific method in decision-making. Various methodologies are utilized in order to evaluate and interpret findings for management action. (Schellenberger.)

B. A. 235. MANAGERIAL ANALYSIS. II (3)

Designed to enable the student to go into greater depth in the use of analytical techniques. Where feasible, data processing is applied and simulated experiences are provided. The aim is to encourage the development of the perceptive approach to complex business situations. (Schellenberger.)

B. A. 237. MANAGEMENT SIMULATION I. (3)

Application of management principles to the solution of complex business problems. This is accomplished in conjunction with the use of computer facilities at the Computer Science Center on the campus. Laboratory fee, $10.00 (effective September, 1964.) (Spivey.)

B. A. 240. Seminar in Financial Management. (1-6)
Prerequisite, B.A. 140. (Himes.)

B. A. 242. Financial Administration. (3)
The role of the financial manager in executive decision making. Financial planning, analysis, and control in such areas as the allocation of financial resources within the firm, forecasting and budgeting, cost and profit controls, capital budgeting and the bases for investment decisions, alternative sources of short-term and long-term financing and financial problems of growth.
(Fisher.)

B. A. 245. Research in Finance. (1-6)
(Fisher.)

B. A. 249. Problems in the Financial Administration. (1-6)
(Fisher.)

B. A. 250. Problems in Sales Management. (1-6)
(Cook.)

B. A. 251. Problems in Advertising. (1-6)
(Ryans.)

B. A. 252. Problems in Retail Management. (1-6)
(Cook.)

B. A. 257. Seminar in Marketing Management. (3)
(Brunner.)

B. A. 258. Research Problems in Marketing. (1-6)
(Cook.)

B. A. 259. Business Logistics. (3)
Involves the optimization of human and material resources by their proper application at the right time and place to support the business enterprise. Consideration is given to analysis of material and manpower requirements, production planning and scheduling, acquisition, inventory control, and distribution. The role of advanced planning and forecasting is considered in minimizing costs and securing the best combination of resources. Impact of technology upon the utilization of resources is considered. (Hille.)

B. A. 262. Seminar in Labor Relations. (1-6)
(Carroll.)

B. A. 264. Behavioral Factors in Management. (3)
Required of M.B.A. candidates. A critical analysis of the impact of the behavioral sciences on traditional concepts of management as process and as organization. Included within the area of analysis are such subjects as human motivation, human relations, morale, status, role, organization, communication, bureaucracy, the executive role, leadership, and training. (Paine.)

B. A. 265. Development and Trends in Production Management. (3)
(Spivey.)

B. A. 266. Personnel Research: Manpower Procurement and Development. (1-6)
(Paine.)

B. A. 267. Personnel Research: Manpower Compensation and Evaluation. (1-6)

(Nash.)

B. A. 269. Application of Behavioral Science to Business. (1-6)

Designed to enable the student to go into greater depth in the design and implementation of behaviorial science research in management. (Paine.)

B. A. 270. Research in Transportation. (1-6)

(Suelflow.)

B. A. 271. Theory of Organization. (3)

(Paine.)

B. A. 272. Seminar in Management of Physical Distribution. (3)

(Bartlett.)

B. A. 275. Special Studies in Transportation. (3)

(Spychalski.)

B. A. 277. Seminar in Transportation. (3)

(Taff.)

B. A. 280. Seminar in Business and Government Relationships. (3)

(Culbertson.)

B. A. 281. Private Enterprise and Public Policy. (3)

Examines the executive's social and ethical responsibilities to his employees, customers, and to the general public. Consideration is given to the conflicts occasioned by competitive relationships in the private sector of business and the effect of institutional restraints. The trends in public policy and their future effect upon management are examined. For comparative purposes, several examples of planned societies are considered. (Culbertson.)

B. A. 282. Product, Production and Pricing Policy Administration. (3)

Required of M.B.A. candidates. The application of economic theory to the business enterprise in respect to the determination of policy and the handling of management problems with particular reference to the firm producing a complex line of products. Nature of competition. Pricing policy. Interrelationship of production and marketing problems. Basic types of cost. Control systems. Theories of depreciation and investment and the impact of each upon costs. (Clemens.)

B. A. 283. Management Policy Formulation. (3)

Affords an insight into the problems confronting top management. A complex management game supplemented by the case method, provides a simulated environment required for dynamic decision-making policy formulation. (Tosi.)

B. A. 284. Seminar in Public Utilities. (1-6)

(Clemens.)

B. A. 290. Seminar in Insurance. (3)

(Clickner.)

B. A. 295. Seminar in Real Estate. (3)

(Clickner.)

B. A. 399. Thesis. (1-6)

CHEMICAL ENGINEERING

Professors: Beckmann, Duffey, Schroeder and Silverman.

Associate Professors: Gomezplata, Marchello and Skolnick.

Assistant Professors: Cadman, Glomb, Munno and Smith.

Lecturers: Goldman and Goldstein.

The Department directs the programs of graduate students who plan to qualify for the degree of Master of Science or Doctor of Philosophy in the Department of Chemical Engineering. Courses in the subject areas of chemical, materials and nuclear engineering are listed below.

The basic requirements for the degrees of Master of Science and Doctor of Philosophy are set forth on pages 8 and 14 of this catalog. Supplemental regulations for guidance of candidates for these degrees in the Department of Chemical Engineering are available in the department office.

THERMODYNAMICS AND ANALYSIS

For Advanced Undergraduates and Graduates

Ch. E. 109. Chemical Process Thermodynamics. (3)
First semester. Prerequisite. Ch. E. 50. Estimation of thermodynamic properties of pure substances and mixtures. Chemical and phase equilibria in ideal and non-ideal systems. Thermodynamic analysis of processes, equilibrium stage operations. thermodynamics of chemically reacting systems. (Cadman.)

Ch. E. 116. Applied Mathematics in Chemical Engineering. (3)
Second semester. Prerequisite. Math. 21 and Ch. E. 127. Mathematical technique applied to the analysis and solution of Chemical Engineering problems. Use of differentiation. integration. differential equations, partial differential equations and integral transforms. Application of infinite series, numerical and statistical methods. (Gomezplata.)

Ch. E. 152. Advanced Chemical Engineering Analysis. (2)
Second semester. Prerequisite. Ch. E. 116. Application of digital and analog computers to chemical engineering problems. Numerical methods, programming, differential equations, curve fitting, amplifiers and analog circuits. (Cadman.)

Ch. E. 154. Numerical and Statistical Analysis. (2)
First semester. Prerequisite, Ch. E. 116. Use of probability and statistics in chemical engineering. Probability, normal distribution and measure of variability. The chi square, and the t-test. Correlation and regression analysis. Introduction to analysis of variance and sequentral analysis. (Smith.)

For Graduates

Ch. E. 203. Chemical Engineering Thermodynamics. (3)
First semester. Advanced application of the general thermodynamic methods to chemical engineering problems. First and second law consequences; estima-

tion and correlation of thermodynamic properties; phase and chemical reaction equilibria. (Glomb.)

Ch. E. 209. Complex Equilibrium Stage Processes. (3)
Second semester. The theory and application of complex equilibrium stages. Binary and multicomponent distillation; multicomponent absorption; extraction; liquefaction. (Glomb.)

Ch. E. 253. Advanced Topics in Thermodynamics. (3)
Second semester. *Offered in alternate years.* Prerequisite, Ch. E. 203. (Staff.)

TRANSPORT AND TRANSFER PHENOMENA

For Advanced Undergraduates and Graduates

Ch. E. 127, 129, 131. Transfer and Transport Processes I, II, III. (4, 3, 3)
First, second, and first semesters, respectively. Prerequisite, Ch. E. 50. A three semester sequence of courses convering the theory and applications of molecular and turbulent transport phenomena. Principles of fluid mechanics, mass transfer and heat transfer. Dimensional analysis, analogy between heat, mass and momentum transfer, Newtonian and non-Newtonian flow, convective heat and mass transfer. Steady and unsteady state diffusion and conduction, simultaneous heat and mass transfer, interphase transfer, boundary layer theory. The equilibrium stage concept and its application to absorption, extraction, and distillation. Analysis of multiple stage processes. Principles of radiant heat transfer, evaporation, filtration, crystallization, drying, condensation, boiling, humidification, ion exchange, and phase separations.
(Smith, Marchello, Glomb.)

Ch. E. 137. Chemical Engineering Laboratory. (3)
First or second semester. Prerequisite, Ch. E. 129. Laboratory fee, $10.00. Application of Chemical Engineering process and unit operation principles in small scale semi-commercial equipment. Data from experimental observations are used to evaluate performance and efficiency of operations. Emphasis is placed on correct presentation of results in report form. (Glomb.)

For Graduates

Ch. E. 205. Transport Phenomena. (3)
First semester. Heat, mass and momentum transfer theory from the viewpoint of the basic transport equations. Steady and unsteady state; laminar and turbulent flow; boundary layer theory, mechanics of turbulent transport; with specific application to compler chemical engineering situations.
(Marchello, Glomb.)

Ch. E. 207. Transfer Operations. (3)
Second semester. Prerequisite, Ch. E. 205. Applications of heat, mass and momentum transfer theory to chemical engineering problems. Transfer coefficients; heat, mass and momentum analogies; two-phase flow; boiling and condensation; radiation heat transfer. (Marchello, Glomb.)

Ch. E. 257. Advanced Topics in Transfer Theory. (3)
First semester. *Offered in alternate years.* Offered 1965-1966. Prerequisite, Ch. E. 207. (Glomb.)

Ch. E. 259. Advanced Topics in Separation Processes. (3)
Second semester. *Offered in alternate years.* Offered 1965-66. (Marchello.)

PROCESS DYNAMICS AND DESIGN

For Advanced Undergraduates and Graduates

Ch. E. 147. Process Engineering and Design. (3)
Second or first semester. Prerequisite, Ch. E. 129. Utilization of chemical engineering principles for the design of process equipment. Typical problems in the design of chemical plants. Comprehensive reports are required. (Schroeder.)

Ch. E. 149. Chemical Engineering Economics. (2)
Second semester. Prerequisite, Ch. E. 129. Principles of engineering economy applied to chemical processes. Optimizing methods in the design and operation of industrial processes. Determination of investment and operating costs for chemical plants. (Schroeder.)

Ch. E. 150. Chemical Process Development. (3)
First semester. Prerequisite, Ch. E. 129. Chemical process industries from the standpoint of technology, raw materials, products and processing equipment. Operations of the major chemical processes and industries combined with quantitative analysis of process requirements and yields. (Schroeder.)

Ch. E. 155. Chemical Process Laboratory. (2)
First semester. Prerequisites, Ch. E. 129, 145, concurrently. Laboratory fee, $10.00. Experimental study of the fundamentals of various chemical processes through laboratory and small semi-commercial scale equipment. Reaction kinetics, fluid mechanics, heat and mass transfer. (Glomb.)

Ch. E. 157. Chemical Engineering Systems Analysis and Dynamics. (3)
Second semester. Prerequisite, Ch. E. 116. Dynamic response applied to process systems. Goals and modes of control; LaPlace transformations; representation, analysis and synthesis of simple control systems; closed loop response; dynamic testing; role of modern computing machinery in process control. (Cadman, Glomb.)

Ch. E. 159. Dynamics and Control Laboratory. (2)
Second semester. Prerequisite, Ch. E. 116, 157 concurrently. Laboratory fee, $10.00. Methods of process control. Dynamics and response of process systems, modes of control, synthesis of simple control schemes. Use of experimental and mathematical models of control systems. (Cadman.)

For Graduates

Ch. E. 223. Process Engineering and Design. (3)
First and second semesters. Coordination of chemical engineering and economics to advanced process engineering and design. Optimization of invest-

ment and operating costs. Solution of typical problems encountered in the design of chemical engineering plants. (Schroeder.)

Ch. E. 235. Chemical Process Dynamics. (3)

First semester. Prerequisites: Differential equations or consent of instructor. Analysis of open and closed control loops and their elements; dynamic response of processes; choice of variables and linkages; dynamic testing and synthesis; noise and drift; chemical process systems analysis; strategies for optimum operation. (Cadman, Smith.)

CHEMICAL REACTION KINETICS

For Advanced Undergraduates and Graduates

Ch. E. 145. Chemical Engineering Kinetics. (2)

First semester. Prerequisite, Chem. 187. Fundamentals of chemical reaction kinetics and their application to the design and operation of chemical reactors. Reaction rate theory, homogeneous reactions in batch and flow systems, adsorption, heterogeneous reactions and catalysis, electrochemical reactions. Catalytic reactor design. (Beckmann, Smith.)

For Graduates

Ch. E. 211. Advanced Chemical Reaction Kinetics. (3)

Second semester. The theory and application of chemical reaction kinetics to reactor design. Reaction rate theory; homogeneous batch and flow reactors; fundamentals of catalysis; design of heterogeneous flow reactors. (Beckmann, Marchello.)

Ch. E. 255. Advanced Topics in Chemical Reaction Systems. (3)

First semester. *Offered in alternate years.* Prerequisite, Ch. E. 211. (Beckmann.)

ENGINEERING MATERIALS

For Advanced Undergraduates and Graduates

Ch. E. 160. Applied Solid State Thermodynamics. (3)

First semester. Prerequisite, Ch. E. 109 or equivalent. Thermodynamics, phase and chemical equilibria. Physical properties and behavior of solids with emphasis on polymeric, metallic, and ceramic materials. (Smith, Skolnick.)

Ch. E. 162. Solid State Transport Phenomena and Reaction Kinetics. (3)

Second semester. Prerequisites, Ch. E. 127 and 145 or equivalent. Transport and reaction kinetic prenomena in the solid state. Mass transfer operations, heat and stress effects, nucleation and phase growth. Diffusion and reaction kinetics in polymer, metallic, and ceramic systems. (Skolnick.)

For Graduates

Ch. E. 261, 262. Chemical-Physical Properties of Materials. (3,3)

Prerequisite, Ch. E. 160 or consent of instructor. A one year sequence dealing with the chemical physics of the solid state. Crystal structure and relationship

to physical properties of solids. Interatomic forces, lattice dynamics and thermal properties. Electrons in periodic fields. Electric and magnetic properties. Statistical thermodynamics and relationship to classical thermodynamics of solids. Theory of alloy phases. (Skolnick.)

Ch. E. 263. Rate Processes in Materials. (3)

Prerequisite. Ch. E. 162 or consent of instructor. Mass transport and reaction kinetic phenomena in materials. Theory and mechanisms of diffusion, nucleation and growth of phases; athermal transformations. Chemical reactions in solids. Combined diffusion and reaction in solid solutions. (Skolnick.)

Ch. E. 264. Rheology of Materials. (3)

Prerequisite, Ch. E. 127 or consent of instructor. Rheological properties of solids and fluids. Introduction to tensor analysis. Mechanical behavior, elasticity, plasticity, visio-elasticity, anelasticity, and relaxation. Behavior of crystalline and amorphorous solids, Newtonian and non-Newtonian fluids.
(Smith, Skolnick.)

NUCLEAR ENGINEERING

For Advanced Undergraduates and Graduates

Ch. E. 140. Introduction to Nuclear Technology. (2)

First and second semesters. Two lectures a week. Prerequisites, Math. 21 and Phys. 21. Engineering problems of the nuclear energy complex, including basic theory, nuclear reactor design, and isotopic and chemical separations. Emphasis is on the nuclear fission reactor. (Duffey.)

Ch. E. 142. Environmental Consideration of Nuclear Engineering. (3)

First semester. Three lectures a week. Prerequisite, permission of instructor. Protection of the public and the environment from the hazards of nuclear energy operations. Handling and disposal of gaseous, liquid and solid radioactive wastes. Meteorological, hydrological and geological phases. Typical problems from mining of ores through nuclear reactor operations and chemical separations. Legislative and economic factors, site selection, plant design and operation as related to the environment. (Silverman, Munno.)

Ch. E. 148. Nuclear Technology Laboratory. (2 to 4)

One or two lectures, and one or two laboratory periods a week. Prerequisites, Chem. 3, Phys. 21, Math. 21, Ch. E. 140, or equivalents, and permission of instructor. Laboratory fee, $8.00 per semester. Techniques of detecting and making measurements of nuclear or high energy radiation. Radiation safety experiments. Both a sub-critical reactor and the 10-KW swimming pool critical reactor are sources of radiation. (Silverman, Munno.)

For Graduates

Ch. E. 302, 303. Nuclear Reactor Engineering. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, permission of instructor. Design, construction and operation of typical nuclear reactors, including general design, nuclear reactor theory, materials of construction, heat transfer, and control. (Duffey.)

Ch. E. 305. Sub-Critical Nuclear Reactor Laboratory. (3)

One lecture, two laboratory periods a week. Prerequisites, Ch. E. 148, 302, 303 or equivalents and permission of instructor. Laboratory fee, $8.00 per semester. Experiments, such as multiplication factors, neutron flux distribution and neutron activation are carried out. (Duffey.)

Ch. E. 308, 309. Nuclear Reactor Laboratory. (4, 4)

Two lectures and two laboratory periods a week. Prerequisites, permission of instructor, Ch. E. 148, 302, 303, 305, or equivalent. Laboratory fee, $10.00 per semester. The University of Maryland 10-KW swimming pool reactor is employed in experiments on reactor startup and operation, shielding, control, neutron flux distributions, neutron and gamma spectrum, cross section measurements. (Duffey.)

Ch. E. 311, 312. Nuclear Separation Engineering. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, permission of instructor. Separations include processing of uranium, thorium, and other ores, chemical separation of plutonium, uranium, fission products and other elements from materials irradiated in nuclear reactors; treatment of radioactive wastes; isotopic separation of U235; and isotopic separation of heavy water and other desired materials. Ch. E. 311 concerns primarily chemical separations, while Ch. E. 312 concerns mostly isotopic separations and fuel cycles. Ch. E. 311 is not necessarily a rerequisite for Ch. E. 312. (Silverman.)

Ch. E. 315, 316. Radiation Engineering. (2, 2)

Second semester. Two lectures a week. Prerequisite, permission of instructor. An engineering survey of such radiation application as synthesizing chemicals, preserving foods, control of industrial processes. Design of irradiation installations, e.g., cobalt 60 gamma ray sources, electronuclear machine arrangements, and chemonuclear reactors. (Silverman.)

Ch. E. 317. Radiation Effects Laboratory. (2 to 4)

Prerequisite, permission of instructor. Effect of massive doses of radiation on the properties of matter for purposes other than those pointed toward nuclear power. Radiation processing, radiation-induced chemical reactions, and conversion of radiation energy; isotope power sources. (Silverman.)

Ch. E. 320, 321. Advanced Nuclear Reactor Theory. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Ch. E. 320, 303, year of advanced calculus, and permission of instructor. Calculation of critical masses, neutron flux distribution, neutron energy spectrum, kinetics of reactor behavior and gamma ray attenuation. Multigroup treatment of reflected reactors, solution of the transport equipment, perturbation theory, and other advanced calculation techniques. (Munno.)

SEMINAR AND RESEARCH

For Undergraduates and Graduates

Ch. E. 133, 134. Chemical Engineering Seminar. (1, 1)

Prerequisite, senior standing. Oral and written reports on recent developments in chemical engineering and the process industries. Fall and Spring Semesters. (Staff.)

Ch. E. 165. Research. (2 or 3)

First and second semesters. Prerequisite, Permission of the staff. Laboratory fee, $10.00. Investigation of a research project under the direction of one of the staff members. Comprehensive reports are required. (Staff.)

For Graduates

Ch. E. 201. Graduate Seminar. (1)

First and second semesters. Discussion of current advances and research in chemical engineering. Presented by graduate students and staff. (Staff.)

Ch. E. 247. Special Problems in Chemical Engineering.

First and second semesters. Special study and/or investigation in chemical engineering under the direction of an assigned faculty advisor. Since content changes, re-registration is permissible. (Staff.)

Ch. E. 301. Seminar in Nuclear Engineering. (1)

First and second semesters, one meeting a week. Survey of nuclear engineering literature, and oral presentation of prepared reports. Since the content of this course is changing, a student may receive a number of credits by re-registration. (Duffey, Silverman, Munno.)

Ch. E. 313. Selected Topics in Nuclear Engineering. (2)

Two lectures a week. Prerequisite, permission of instructor. Topics of current interest and recent advances in the nuclear engineering field. Because of the rapid advances in the field, information on special topics of much practical importance is continually becoming available. Since the content changes, re-registration may be permitted. (Duffey, Silverman, Munno.)

Ch. E. 314. Special Problems in Nuclear Engineering.

Credit hours to be arranged. Prerequisite, consent of instructor. Laboratory fee, $10.00 per semester. (Staff.)

Ch. E. 399. Research in Chemical Engineering. Research in Nuclear Engineering.

Credit hours to be arranged. Laboratory fee, $8.00 per semester (Research in Chemical Engineering). Laboratory fee, $10.00 per semester (Research in Nuclear Engineering). The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Staff.)

ENGINEERING MATERIALS

This program is given jointly by the Department of Chemical Engineering and the Department of Mechanical Engineering and offers courses of study leading to the degrees of Master of Science and Doctor of Philosophy. The program is open to qualified students holding Bachelor degrees in engineering, the physical sciences, and mathematics.

Courses to satisfy the major requirements in Engineering Materials must be selected from those designated as materials engineering by the Chemical and Mechanical Engineering Departments. Courses to satisfy the minor

may be chosen from Chemistry, Physics, Mathematics or other engineering courses including chemical and mechanical engineering.

NUCLEAR ENGINEERING

This program is offered by the Department of Chemical Engineering and represents courses of study leading to the degrees of Master of Science and Doctor of Philosophy. The program is open to qualified students holding bachelor degrees in engineering, the physical sciences and mathematics. Courses to satisfy the major requirements in Nuclear Engineering must be selected from those designated as nuclear engineering by the Chemical Engineering Department. Courses to satisfy the minor may be chosen from Chemistry, Physics, Mathematics or other engineering courses including chemical engineering.

CHEMISTRY

Professors: WHITE, JAQUITH, LIPPINCOTT, PRATT, PURDY, REEVE, ROLLINSON, SVIRBELY, VEITCH, AND WOODS.

Research Professor: BAILEY.

Associate Professors: ATKINSON, GORDON, GRIM, HENERY-LOGAN, KASLER, PICKARD, STEWART, AND STUNTZ.

Assistant Professors: BELLAMA, BOYD, GARDNER, HUHERY, LAKSHMANAN, MILLER, SPIVEY, AND STALEY.

The Chemistry Department offers programs leading to the M.S. or the Ph.D. degrees in analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, physical chemistry, and chemical physics. For the latter program, the Chemistry Department cooperates with the Institute for Molecular Physics and the Department of Physics and Astronomy in both M.S. and Ph.D. programs.

Basic requirements for the M.S. and Ph.D. degrees are set forth on pages 8 and 14 of this catalog. Departmental regulations concerning qualifying and comprehensive examinations and other matters pertaining to course work have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Chemistry.

Laboratory fees in Chemistry are $12.00 per laboratory course per semester except in Chemistry 270, for which the fee is $20.00.

ANALYTICAL CHEMISTRY

For Graduates and Advanced Undergraduates

CHEM. 123. ADVANCED QUANTITATIVE ANALYSIS. (4)
Two lectures and two three-hour laboratory periods per week. Prerequisite, Chem. 187. An intensive study of the theory and techniques of inorganic

quantitative analysis, including volumetric, gravimetric, electrometric and colorimetric methods. (Purdy.)

CHEM. 125. INSTRUMENTAL ANALYSIS. (4)

Second semester. Two lectures and six hours of laboratory per week. Prerequisite, Chem. 189, 184 or concurrent registration therein. A study of the application of physico-chemical methods to analytical chemistry. Techniques such as polarography, potentiometry, conductivity and spectrophotometry will be included. (Purdy.)

CHEM. 150. ORGANIC QUANTITATIVE ANALYSIS. (2)

Two three-hour laboratory periods per week. Prerequisite, consent of instructor. The semi-micro determination of carbon, hydrogen, nitrogen, halogen and certain functional groups. (Kasler.)

For Graduates

CHEM. 206, 208. SPECTROGRAPHIC ANALYSIS. (1, 1)

One three-hour laboratory a week. Prerequisites, Chem. 182, 184 or 188, 190, and consent of the instructor. Registration limited. (White.)

CHEM. 221, 223. CHEMICAL MICROSCOPY. (2, 2)

First and second semesters. One lecture and one three-hour laboratory period a week. Prerequisite, consent of instructor. Registration limited. A study of the construction and optics of the microscope and its applications in chemistry, with particular emphasis on the optical properties of crystals. (Stuntz.)

CHEM. 225. ADVANCED INSTRUMENTAL ANALYSIS. (4)

Second semester. Two lectures and six hours of laboratory per week. Prerequisites, Chem. 189, 184 or concurrent registration therein. An intensive study of physico-chemical methods as applied to analytical chemistry. Laboratory work will include experiments in such fields as polarography, coulometry and amperometry, potentiometry and spectrophotometry, nephlometry. (Purdy.)

CHEM. 226. SELECTED TOPICS IN ANALYTICAL CHEMISTRY. (4)

First semester. Two lectures and two three-hour laboratory periods per week. Prerequisites, Chem. 125, 225, or consent of instructor. A study of advanced methods with emphasis on the modern techniques of analytical chemistry. (Purdy.)

BIOCHEMISTRY

For Graduates and Advanced Undergraduates

CHEM. 161, 163. BIOCHEMISTRY. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, Chem 33, or Chem. 37. (Henery-Logan.)

CHEM. 162, 164. BIOCHEMISTRY LABORATORY. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 33, Chem. 38, or Chem. 40. (Henery-Logan.)

For Graduates

CHEM. 261, 263. ADVANCED BIOCHEMISTRY. (2, 2)

First and second semesters. Prerequisites, Chem. 143 or consent of instructor. Two lectures a week. (Veitch.)

CHEM. 262, 264. ADVANCED BIOCHEMISTRY LABORATORY. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, consent of the instructor. (Veitch.)

CHEM. 265. ENZYMES. (2)

Two lectures a week. Prerequisite, Chem. 163. (Veitch.)

CHEM. 267. THE CHEMISTRY OF NATURAL PRODUCTS. (2)

Two lectures a week. Prerequisite, Chem. 143. The chemistry and physiological action of natural products. Methods of isolation, determination of structure, and synthesis. (Henery-Logan.)

CHEM. 268. SPECIAL PROBLEMS IN BIOCHEMISTRY. (2-4)

Two to four three-hour laboratory periods a week. Prerequisites, Chem. 161, 162, 163, 164, and consent of the instructor. (Veitch, Henery-Logan.)

CHEM. 269. ADVANCED RADIOCHEMISTRY. (2)

Second semester. Two lectures a week. Prerequisite, Chem. 205 or consent of instructor. Utilization of radioisotopes with special emphasis on applications to problems in the life sciences. (Lakshmanan.)

CHEM. 270. ADVANCED RADIOCHEMISTRY LABORATORY. (1-2)

Second semester. One or two four-hour laboratory periods per week. Prerequisites, Chem. 210 and Chem. 269 (or concurrent registration in Chem. 269) and consent of instructor. Registration limited. Laboratory training in utilization of radioisotopes with special emphasis on applications to problems in life sciences. (Lakshmanan.)

CHEM 271. SPECIAL TOPICS IN BIOCHEMISTRY. BIOCHEMISTRY OF LIPIDS. (2)

Two lectures a week. Classification and chemistry of lipids; lipogenesis, and energy metabolism of lipids; structural lipids and endocrine control of lipid metabolism in mammals. (Lakshmanan.)

CHEM. 273. SPECIAL TOPICS IN BIOCHEMISTRY. COMPARATIVE BIOCHEMISTRY. (2)

Two lectures a week. Energy sources and micronutrient requirements; gluconeogenesis; osmoregulation; nitrogen metabolism; detoxication and excretion; and comparative endocrinology. Deals with chordates only. (Lakshmanan.)

INORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

CHEM. 101. INORGANIC CHEMISTRY. (3)

Second semester. Three lectures a week. Prerequisites, Chem. 37, 187. (Staff.)

CHEM. 102. INORGANIC PREPARATIONS. (2)
Second semester. Prerequisite, Chem. 123. Two three-hour laboratory periods per week. (Staff.)

CHEM. 111. CHEMICAL PRINCIPLES. (4)
Two lectures and two three-hour laboratory periods a week. Prerequisites, Chem. 1 and 3, or equivalent. Not open to students seeking a major in the physical sciences, since the course content is covered elsewhere in their curricula. A course in the principles of chemistry with accompanying laboratory work consisting of single quantitative experiments. (Credit applicable only toward degree in College of Education.) (Jaquith.)

For Graduates

CHEM. 201. ADVANCED INORGANIC CHEMISTRY. (2)
Two lectures per week. (Staff.)

CHEM. 203. THE CHEMISTRY OF THE RARER ELEMENTS. (2)
First and second semesters. Two lectures a week. (White.)

CHEM. 202, 204. ADVANCED INORGANIC LABORATORY. (2, 2)
First and second semesters. Two three-hour laboratory periods a week. (Boyd.)

CHEM. 205. RADIOCHEMISTRY. (2)
Two lectures a week. (Rollinson.)

CHEM. 207. CHEMISTRY OF COORDINATION COMPOUNDS. (2)
Two lectures a week. (Rollinson, Gordon.)

CHEM. 209. NON-AQUEOUS INORGANIC SOLVENTS. (2)
Two lectures a week. (Jaquith.)

CHEM. 210. RADIOCHEMISTRY LABORATORY. (1 or 2)
One or two four-hour laboratory periods a week. Registration limited. Prerequisites, Chem. 205 (or concurrent registration therein) and consent of instructor. (Lakshmanan.)

CHEM. 211. CHEMISTRY OF ORGANOMETALLIC COMPOUNDS. (2)
Two lectures per week. (Grim.)

CHEM. 213. SELECTED TOPICS IN INORGANIC CHEMISTRY. (2)
Two lectures a week. Prerequisites, Chem. 201, or equivalent. An examination of some current topics in modern inorganic chemistry. (Staff.)

ORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

CHEM. 141, 143. ADVANCED ORGANIC CHEMISTRY. (2, 2)
First and second semesters. Two lectures a week. Prerequisites, Chem. 37 and 38 or 40. An advanced study of the compounds of carbon. (Reeve.)

CHEM. 144. ADVANCED ORGANIC LABORATORY. (2-4)
First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 37, and 38 or 40. (Pratt.)

CHEM. 148. THE IDENTIFICATION OF ORGANIC COMPOUNDS. (2)
First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. The systematic identification of organic compounds. (Pratt.)

For Graduates

(One or more courses from the following group 240-254 will customarily be offered each semester.)

CHEM. 240. ORGANIC CHEMISTRY OF HIGH POLYMERS. (2)
Two lectures a week. Prerequisites, Chem. 141, 143. An advanced course covering the synthesis of monomers, mechanism of polymerization, and the correlation between structure and properties in high polymers. (Bailey.)

CHEM. 241. STEREOCHEMISTRY. (2)
Two lectures a week. (Woods.)

CHEM. 243. MOLECULAR ORBITAL THEORY. (2)
Two lectures a week. (Staley.)

CHEM. 245. THE CHEMISTRY OF THE STEROIDS. (2)
Two lectures a week. (Pratt.)

CHEM. 249. PHYSICAL ASPECTS OF ORGANIC CHEMISTRY. (2)
Two lectures a week. (Woods.)

CHEM. 251. THE HETEROCYCLICS. (2)
Two lectures a week. (Pratt.)

CHEM. 254. ADVANCED ORGANIC PREPARATIONS. (2-4)
First and second semesters. Two or four three-hour laboratory periods a week. (Pratt.)

CHEM. 258. THE IDENTIFICATION OF ORGANIC COMPOUNDS, AN ADVANCED COURSE. (2-4)
First and second semesters. Two to four three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. (Pratt.)

PHYSICAL CHEMISTRY

For Graduates and Advanced Undergraduates

CHEM. 182, 184. PHYSICAL CHEMISTRY LABORATORY FOR CHEMISTRY MAJORS. (1, 1)
First and second semesters. One three-hour laboratory period a week. (Staff.)

CHEM. 187, 189. PHYSICAL CHEMISTRY. (3, 3)
First and second semesters. Three lectures a week. Prerequisites, Chem. 19 or 21; Phys. 20, 21; Math. 20, 21, or consent of instructor. This course must be accompanied by Chem. 188, 190, or Chem. 182, 184, unless excused by the instructor. (Svirbely.)

CHEM. 188, 190. PHYSICAL CHEMISTRY LABORATORY. (1 or 2, 1 or 2)
First and second semesters. Two three-hour laboratory periods a week. A laboratory course for students taking Chem. 187, 189. (Staff.)

CHEM. 195. ADVANCED PHYSICAL CHEMISTRY. (2)
Two lectures a week. Prerequisite, Chem. 189. Quantum chemistry and other selected topics. (Staff.)

For Graduates

The common prerequisites for the following courses are Chem. 187 and 189.

One or more courses of the group, 281-323, will be offered each semester, depending on demand.

CHEM. 281. THEORY OF SOLUTIONS. (2)
Two lectures a week. Prerequisite, Chem. 307, or equivalent. (Svirbely.)

CHEM. 285. COLLOID CHEMISTRY. (2)
Two lectures a week. (Pickard.)

CHEM. 287. INFRA-RED AND RAMAN SPECTROSCOPY. (2)
Two lectures a week. Prerequisites, Chem. 141, 143, 187, 189 and consent of instructor. (Lippincott.)

CHEM. 295. HETEROGENEOUS EQUILIBRIA. (2)
Two lectures a week. (Pickard.)

CHEM. 299. REACTION KINETICS. (3)
Three lectures a week. (Svirbely.)

CHEM. 303. ELECTROCHEMISTRY. (3)
Three lectures a week. (Atkinson.)

CHEM. 304. ELECTROCHEMISTRY LABORATORY. (2)
Two three-hour laboratory periods a week. Prerequisite, consent of instructor. (Svirbely.)

CHEM. 307. CHEMICAL THERMODYNAMICS. (3)
Three lectures a week. (Pickard.)

CHEM. 311. PHYSIOCHEMICAL CALCULATIONS. (2)
Two lectures a week. (Stewart.)

CHEM. 313. MOLECULAR STRUCTURE. (3)
Three lectures a week. (Lippincott.)

Chem. 317. Chemical Crystallography. (3)
Three lectures per week. Prerequisite, consent of instructor. (Stewart.)

Chem. 319, 321. Quantum Chemistry. (3, 3)
Three and two lectures a week. Prerequisite, Chem. 307 and 195, or equivalent. (Staff.)

Chem. 323. Statistical Mechanics and Chemistry. (3)
Three lectures a week. Prerequisite, Chem. 307 or equivalent. (Staff.)

SEMINAR AND RESEARCH

Chem. 351. Seminar. (1)
First and second semesters. (Staff.)

Chem. 399. Thesis Research.
First and second semesters, summer session. (Staff.)

CIVIL ENGINEERING

Professors: Looney, Allen, Lepper, and Otts.

Associate Professors: Barber, Cournyn, Piper and Wedding.

Assistant Professors: Cookson, Garber and Mercier.

Lecturers: Bloem, Roberts and Walker.

The Civil Engineering Department offers graduate work in the following fields: engineering materials, highway engineering, hydraulic engineering, sanitary engineering, soils and foundations, and structural engineering, leading to the degrees of Master of Science and Doctor of Philosophy.

For Graduates and Advanced Undergraduates

ENCE. 100. Engineering Analysis and Computer Programming. (3)
Second semester. Three lectures each week. Prerequisite, ENCE 112 or concurrent registration. (Garber.)

ENCE. 102. Fundamentals of Structural Analysis. (3)
First semester. Three lectures each week. Prerequisites, E. S. 20 and ENCE 50. (Lepper and Piper.)

ENCE.103. Basic Structural Design. (3)
Second semester. Three lectures each week. Prerequisite, ENCE 102. (Lepper and Piper.)

ENCE. 104. Computer Analysis. (3)
First semester. Two lectures and one laboratory each week. Prerequisites. ENCE 100 and ENCE 102. (Garber.)

ENCE. 105. Basic Fluid Mechanics. (3)
First semester. Three lectures each week. Prerequisite, E. S. 20, 21, Physics 20. Prerequisite, M. E. 105. (Cournyn and Reilly.)

ENCE. 106. Fundamentals of Sanitary Engineering. (3)
Second semester. Three lectures each week. Prerequisite, ENCE 105.
(Otts and Cookson.)

ENCE. 107. Fundamentals of Soil Mechanics. (3)
First semester. Three lectures each week. Prerequisites, E. S. 20 and ENCE 50.
(Barber.)

ENCE. 108. Fundamentals of Transportation Engineering. (3)
Second semester. Prerequisite, ENCE 50 and ENCE 90.
(Wedding and Barber.)

ENCE. 109. Basic Civil Engineering Planning I. (2)
First semester. Three lectures each week. Prerequisites, ENCE 103, 106, 107 and 108. (Piper.)

ENCE. 110. Basic Civil Engineering Planning II. (1)
Second semester. One laboratory of three hours each week. Prerequisite, ENCE 109. (Piper.)

ENCE. 112. Applied Mathematics in Engineering. (3)
First semester. Three lectures each week. Prerequisite, Math. 22.
(Mercier.)

ENCE. 125. Advanced Strength of Materials. (3)
First semester. Three lectures each week. Prerequisite, E. S. 20. (Lepper.)

ENCE. 126. Experimental Stress Analysis. (4)
Second semester. Three lectures and one laboratory per week.
(Lepper and Wedding.)

ENCE. 127. Theory of Elasticity and Plasticity. (3)
Three lectures each week. Prerequisites, E. S. 20 and ENCE 112.
(Mercier.)

ENCE. 135. Advanced Soil Mechanics. (4)
Three lectures and one laboratory each week. Prerequisite, ENCE 107.
(Barber.)

ENCE. 145. Advanced Fluid Mechanics. (4)
Three lectures and one laboratory each week. Prerequisite, ENCE 105.
(Cournyn and Reilly.)

ENCE. 155. Advanced Materials of Engineering. (3)
Three lectures each week. Prerequisite, ENCE 50. (Wedding.)

ENCE. 165. Structural Analysis. (3)
First semester. Three lectures each week. Prerequisite, ENCE 103.
(Garber and Schelling.)

ENCE. 166. Structural Design. (4)
Second semester. Two lectures and one laboratory each week. Prerequisite, ENCE 103. (Garber and Schelling.)

ENCE. 175. Sanitary Engineering Analysis and Design. (4)
First semester. Three lectures and one laboratory each week.
(Otts and Cookson.)

ENCE. 176. Environmental Engineering. (3)
Second semester. Two lectures and one laboratory each week.
(Otts and Cookson.)

ENCE. 185. Highway Engineering. (3)
First semester. Three lectures each week. Prerequisite, ENCE 107. (Barber.)

ENCE. 186. Transportation Engineering. (3)
Second semester. Three lectures each week. Prerequisite, ENCE 108.
(Barber and Wedding.)

ENCE. 195. Advanced Surveying. (3)
Two lectures and one laboratory each week. Prerequisite, ENCE 90.
(Staff.)

ENCE. 199. Special Problems. (3)
Prerequisite, senior standing. (Staff.)

For Graduates

ENCE. 221, 222. Advanced Strength of Materials. (3, 3)
First and second semesters. Prerequisites, E. S. 20, 21 and ENCE 50 or equivalent. Analyses for stress and deformation in engineering members by the methods of mechanics of materials and elementary theories of elasticity and plasticity. Problems in flexure, torsion, plates and shells, stress concentrations, indeterminate combinations, residual stresses, stability. (Lepper.)

ENCE. 223. Experimental Stress Analysis. (3)
Second semester. Prerequisite, ENCE 221 or permission of instructor. Experimental methods of stress and strain analysis for static and impact forces. Use of structural models; brittle and plastic material methods; analogies; photoelasticity; optical, mechanical and electrical strain gages and instrumentation. (Wedding.)

ENCE. 224. Advanced Engineering Materials Laboratory. (3)
First or second semester. Prerequisite, E.S. 20, 21 and ENCE 50 or equivalent. Critical examination of the methods for testing engineering materials and structures under static, repeated, sustained and impact forces. Laboratory experiments for the determination of strength and stiffness of structural alloys, concrete and other construction materials. Critical examination of the effects of test factors on the determination of engineering properties. (Lepper, Wedding.)

ENCE. 225, 226. Advanced Properties of Materials. (3, 3)
First and second semesters. Prerequisite, ENCE 221 and 222. Modern theories of the structure of matter applied to the study of elastic and plastic deformation of materials under static. repeated, sustained and impact forces. Elements of solid state physics, crystal structure, slip and dislocation theory; polycrystalline solids. Effects of low and high temperature, loading rates, and state of stress on mechanical properties and fractures. Critical study of tests and their application to strength of members. (Lepper.)

ENCE. 227, 228. Theories of Concrete and Granular Materials. (3, 3)

First and second semesters. Prerequisites, ENCE 221, 222, 224. Critical reviews of analytical and experimental investigations of the behavior of concretes under diverse conditions of loading and environment. Mechanics of granular aggregates and the chemistry of cements. Theories for the design of Portland cement and asphaltic concrete mixtures. Relations between laboratory testing and field experience. (Wedding.)

ENCE. 241. Hydraulic Engineering. (3)

First or second semester. Prerequisite, ENCE 105 or equivalent. Water power and flood control. Analysis of the principal features of a water power project with special reference to reservoir, waterway, dam, plant accessories, and power house equipment. Complete report on a water power project required, including costs and power valuation. (Cournyn.)

ENCE. 251. Soil Mechanics. (3)

First or second semester. Prerequisite, ENCE 107, or equivalent. Identification properties tests and classification methods for earth materials. Strength and deformation characteristics, hydraulic properties and permeability, shearing resistance, compressibility and consolidation, with laboratory tests for these properties. Study of the basic theories involved and the development of test procedures. (Barber.)

ENCE. 252. Advanced Foundations. (3)

First or second semesters. Prerequisites, ENCE 107, 165 and 166, or equivalent. Principles of mechanics applied to engineering problems in foundations. Earth pressure theories, seepage and drainage phenomena, stability of footings and slopes, stresses and deformation in soils, consolidation theory and application to foundation settlements. (Barber.)

ENCE. 261. Civil Engineering Planning. (3)

First semester. Prerequisites, ENCE 102, 103, 165 and 166, or equivalent. General planning of large engineering projects involving industrial plants, bridges, highways, railroads, and port developments. Emphasis on general planning followed by design construction and cost estimates. (Piper.)

ENCE. 262. Civil Engineering Planning. (3)

Second semester. Prerequisite, ENCE 261. City and regional planning and development. Special problem of municipal development. Emphasis on preparing engineering reports, financing and cost estimates. Preparation of presentation to public bodies. (Piper.)

ENCE. 263. Theory of Structural Design. (3)

First semester. Prerequisite, ENCE 102, 103, 165 and 166, or equivalent. Advanced structural theory applied to the design of bridges and buildings. Methods of analysis for indeterminate structures, including movement distribution, Maxwell's method, virtual work, reciprocal theory, Muller Breslau's principle, and classical analytical methods. (Looney.)

ENCE. 264. Theory of Structural Design. (3)

Second semester. Prerequisite, ENCE 263. Correlation of theory, experience, and experiments in study of structural behavior, proportioning, and preliminary design. Special design problems of fatigue, buckling, vibrations, and impact. (Looney.)

ENCE. 265, 266. Concrete Structures. (3, 3)

First and second semesters. Prerequisites, ENCE 263 and 264. Examination of the fundamental basis for the design of reinforced concrete structures. Correlation of laboratory research, advanced structural theory and mechanics, and design methods. Application to the design of modern forms of concrete structures, such as folded plates, slabs, thin shells, life slabs, prestressing, and precasting. (Looney.)

ENCE. 267, 268. Steel Structures. (3, 3)

First and second semesters. Prerequisites, ENCE 263 and 264. Design of large steel structures, such as cantilever and continuous trusses and girders, steel arches, suspension bridges, and tall building frames. Special problems of secondary stresses, wind bracing, stability and bracing, and interaction and deformation stresses. Study of specifications, factor of safety and ultimate strength, and the relation between structural tests and design. (Looney.)

ENCE. 271, 272. Sanitary Engineering Design. (3, 3)

First and second semesters. Prerequisite, ENCE 106, 175 and 176, or equivalent. Practical problems in the design of sewer systems and appurtenances; sewage treatment plants; water collection and distribution systems; water purification plants. Selected design of structures related to the operation of water supply and sewerage systems and industrial waste treatment plants. (Otts.)

ENCE. 281, 282. Advanced Highway Engineering. (3, 3)

First and second semesters. Prerequisites, ENCE 107, 185, and 186 or equivalent. Reconnaissance and location, surveys and plans, drainage, subgrade structure, low-cost roads, base courses, flexible and rigid pavement design. Highway organization planning economy, and finance. Geometric design and traffic engineering. (Barber.)

ENCE. 296, 297. Engineering Analysis and Computer Programming. (3, 3)

First and second semesters. Three lectures each week. Prerequisites, eonsent of Head of Department. Engineering Analysis and Computer Programming as applied to elasticity, stability and buckling, vibrations, thin plates and shells, or other problems in the area of mechanics, structures and materials. (Roberts.)

ENCE. 298. Seminar.

First or second semester. Credit in accordance with work outlined by the Department. Prerequisite, consent of the Department of Civil Engineering. (Staff.)

ENCE. 399. Research.

First and second semesters. Credit in accordance with work done. (Staff.)

CLASSICAL LANGUAGES AND LITERATURES

Professor: Avery.

The Department of Classical Languages and Literatures offers no program leading to the degrees of Master of Arts or Doctor of Philosophy at the present time. The following courses, however, are offered upon sufficient

demand to fill the needs of graduate students in other fields, such as English, history, and modern foreign languages, who may wish to work in Latin in connection with their degree programs in such fields. Students should consult their major professors with respect to application of credit hours in Latin to their graduate programs.

For Graduates and Advanced Undergraduates

Prerequisite, Latin 61 or equivalent.

Latin 101. Catullus and the Roman Elegac Poets. (3)
Lectures and readings on Catullus as a writer of lyric, an imitator of the Alexandrians, and as a writer of elegy, and on Tibullus, Propertius, and Ovid as elegists. The reading of selected poems of the four authors. Reports. (Avery.)

Latin 102. Tacitus. (3)
Lectures and readings on Greek and Roman historiography before Tacitus and on the author as a writer of history. The reading of selections from the Annals and Histories. Reports. (Avery.)

Latin 103. Roman Satire. (3)
Lectures and readings on the origins and development of Roman satire. The reading of selections from the satires of Horace, Petronius' Cena Trimalchionis, and the satires of Juvenal. Reports. (Avery.)

Latin 104. Roman Comedy. (3)
Lectures and readings on the origins and development of Roman comedy. The reading of selected plays of Plautus and Terence. Reports. (Avery.)

Latin 105. Lucretius. (3)
Lectures and readings on Greek and Roman Epicureanism. The reading of selections from the *De rerum natura*. Reports. (Avery.)

Latin 111. Advanced Latin Grammar. (3)
An intensive study of the morphology and syntax of the Latin language supplemented by rapid reading. (Avery.)

Latin 199. Latin Readings. (3)
Special Prerequisite, Consent of Instructor. The reading of one or more selected Latin authors from antiquity through the Renaissance. May be repeated with varying content. Reports. (Avery.)

For Graduates

Prerequisite, Latin 61 or equivalent.

Latin 210. Vulgar Latin Readings. (3)
An intense study of the phonology, morphology, and syntax of Classical Latin, followed by the study of the deviations of Vulgar Latin from the classical norms, with the reading of illustrative texts. The reading of selections from the Preregrination ad loca sancta and the study of divergences from classical usage therein, with special emphasis on those which anticipate subsequent development in the Romance Languages. Reports. (Avery.)

COMPARATIVE LITERATURE

Professors: Aldridge, Cooley, Goodwyn, Jones, Levitine, Montano, and Prahl.

Assistant Professor: Evans.

The Department of Comparative Literature offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

MASTER OF ARTS

Candidates for the degree must have an undergraduate major in one language or literature acceptable for admission to graduate work in that department. Those who offer a major in English must have in addition a knowledge of at least one foreign language. Requirements for the degree include Comparative Literature 201 and nine other hours of courses in Comparative Literature as well as 12 hours of courses in English, classical or foreign languages.

DOCTOR OF PHILOSOPHY

Candidates must have an M.A. degree in comparative literature or any language or literature. Departmental requirements for the degree include Comparative Literature 301 and 33 additional hours of courses in comparative literature, English, classical or foreign languages. The student must designate as a special field a chronological period (such as the Renaissance, Enlightenment, or Age of Realism) or a literary type (such as epic, drama or novel) or a literary theme (such as patriotism, the Faust legend or primitivism). The majority of his courses must relate to the special field and be selected from at least three departments so as to satisfy the major-minor requirements of the Graduate School. The dissertation must be related to the major field.

For Graduates and Advanced Undergraduates

Comp. Lit. 101, 102. Introductory Survey of Comparative Literature. (3, 3)

First semester: Survey of the background of European literature through study of Greek and Latin literature in English translations, discussing the debt of modern literature to the ancients. Second semester: Study of medieval and modern Continental literature. (Staff.)

Comp. Lit. 103. The Old Testament as Literature. (3)

Second semester. A study of the sources, development and literary types. (Evans.)

Comp. Lit. 105. Romanticism in France. (3)

First semester. Lectures and readings in the French romantic writers from Rousseau to Baudelaire. Texts are read in English translations. (Aldridge.)

Comp. Lit. 106. Romanticism in Germany. (3)
Second semester. Continuation of Comp. Lit. 105. German literature from Buerger to Heine in English translations. (Prahl.)

Comp. Lit. 107. The Faust Legend in English and German Literature. (3)
A study of the Faust legend of the Middle Ages and its later treatment by Marlowe in *Dr. Faustus* and by Goethe in *Faust*. (Prahl.)

Comp. Lit. 112. Ibsen. (3)
First semester. A study of the life and chief works of Henrik Ibsen with special emphasis on his influence on the modern drama. (Staff.)

Comp. Lit. 114. The Greek Drama. (3)
First semester. The chief works of Aeschylus, Sophocles, Euripides and Aristophanes in English translations. Emphasis on the historic background, on dramatic structure, and on the effect of the Attic drama upon the mind of the civilized world. (Prahl.)

Comp. Lit. 125. Literature of the Middle Ages. (3)
Narrative, dramatic, and lyric literature of the Middle Ages; studies in translations. (Cooley.)

Comp. Lit. 130. The Continental Novel. (3)
First semester. The European novel in translation from Stendhal through the Existentialists, selected from literatures of France, Germany, Italy, Russia and Spain. (Staff.)

Comp. Lit. 135. Dante and the Romance Tradition. (3)
A reading of the *Divine Comedy* to enlighten the discovery of reality in western literature. (Montano.)

Comp. Lit. 140. Literature of the Far East. (3)
Classics of the Orient in translation. (Evans.)

In addition, all literature courses numbered 100 or above offered in the Classics, English, and Foreign Languages Departments may be accepted for Comparative Literature credit.

For Graduates

Comp. Lit. 201. Problems in Comparative Literature. (3)
Second semester. A research seminar for M. A. candidates only. (Staff.)

Comp. Lit. 225. The Medieval Epic. (3)
A comparative interpretation of *Beowulf, the Waltharius,* the *Chanson de Roland,* the *Nibelungenlied,* and the *Cid*. (Jones.)

Comp. Lit. 226. The Medieval Romance. (3)
Second semester. An interpretation of the principal works of the genre. (Jones.)

Comp. Lit. 230. Problems of the Baroque in Literature. (3)
First semester. The passage from Mannerism to the most characteristic theoretical and creative manifestations of Baroque. (Montano.)

Comp. Lit. 240. Literary Criticism: Ancient and Medieval. (3)
First semester. From Aristotle to the fifteenth century. (Montano.)

Comp. Lit. 241. Literary Criticism: Renaissance and Modern. (3)
Second semester. From Petrarch to the present. (Montano.)

Comp. Lit. 258. Folklore in Literature. (3)
A study of folk heroes, motifs, and ideas as they appear in the world's masterpieces. (Goodwyn.)

Comp. Lit. 268. Seminar in Literary Sources of Art History. (3)
Second semester. Art historical sources from Pliny to Malraux. (Same as Art 268.) (Levitine.)

Comp. Lit. 301. Seminar in Themes and Types. (3)
Prerequisite, one year's work in literature and the knowledge of one language other than English. Intensive study of fundamental motifs and trends in western literature. (Aldridge.)

In addition, all literature courses numbered 100 or above offered in the Classics, English, and Foreign Languages Departments may be accepted for Comparative Literature credit.

DAIRY SCIENCE

Professors: Davis, Arbuckle, and Keeney.

Associate Professors: Hemken, King, Mattick, Stewart, Williams and Vandersall.

The Department of Dairy Science offers work leading to the degree of Master of Science and Doctor of Philosophy. Candidates for the Doctor of Philosophy degree have the option of studying in one of two major fields: dairy production, which is concerned with breeding, nutrition and physiology of dairy animals, or dairy technology, which is concerned with chemical, bacteriological, and nutritional aspects of dairy products, as well as the industrial phases of milk processing. Students interested in food science may undertake graduate study in the dairy technology phase of Dairy Science.

FOOD SCIENCE (DAIRY TECHNOLOGY)

For Graduates and Advanced Undergraduates

Fd. Sc. 102. Principles of Food Processing I. (3)
See Horticulture for description. (Wiley.)

Fd. Sc. 103. Principles of Food Processing II. (3)
First semester. Three lectures per week. A detailed study of food processing with emphasis on line and staff operations, including physical facilities, utilities, pre- and post-processing operations, processing line development and sanitation. (Mattick.)

Fd. Sc. 111. Food Chemistry. (3)
First semester. Two lectures and one laboratory per week. Prerequisites, organic chemistry. The application of basic chemical and physical concepts to the composition and properties of foods. Emphasis will be on the relationship of processing technology on the keeping quality, nutritional value and acceptability of foods. (King.)

Fd. Sc. 112. Analytical Quality Control. (3)
See Horticulture for description (Kramer.)

Fd. Sc. 113. Statistical Quality Control. (3)
See Horticulture for description. (Kramer.)

Fd. Sc. 125. Meat and Meat Processing. (3)
See Animal Science for description. (Staff.)

Fd. Sc. 131. Food Product Research and Development. (3)
Second semester. Two lectures, one laboratory per week. A study of the research and development function for improvement of existing products and development of new, economically feasible and marketable food products. Application of chemical-physical characteristics of ingredients to produce optimum quality products, cost reduction, consumer evaluation, equipment and package development. (Staff.)

Fd. Sc. 156. Horticultural Products Processing. (3)
See Horticulture for description. (Wiley.)

Fd. Sc. 160. Technology of Market Eggs and Poultry.
See Poultry Science for description. (Helbacka.)

Fd. Sc. 182. Dairy Products Processing. (3)
Second semester. Two lectures and one laboratory per week. Method of production of fluid milk, butter, cheese, condensed and evaporated milk and milk products and ice cream. (Mattick.)

Mechanics of Food Processing.
See Agricultural Engineering, Agr. Eng. 113.

Experimental Food Science.
See Food and Nutrition, Food 153.

For Graduates

Experimental Processing.
See Horticulture, Hort. 210.

Research Methods.
See Dairy Science, An. Sc. 241.

Methods of Horticultural Research.
See Horticulture, Hort. 207.

Special Problems in Animal Science.
See Animal Science, Dairy Science and Poultry Science, An. Sc. 301.

Fd. Sc. 303. Advanced Seminar. (1)
First and second semesters. Oral reports with illustrative material are required on special topics or recent research publications in food science and technology. A maximum of three credit hours are allowed for the M. S. degree or six credit hours for the doctoral degree. (Staff.)

Fd. Sc. 399. Thesis Research. (1-12)
First and second semesters; summer session. The investigation is planned and conducted under faculty supervision. Grades are awarded on completion of the thesis. (Staff.)

For Graduates and Advanced Undergraduates

An. Sc. 140. Physiology of Reproduction. (2)
First semester. One lecture and one three-hour laboratory period per week. Prerequisite, Zoology 102 or 104. Anatomy and physiology of the reproductive process and artificial insemination of cattle. (Williams.)

An. Sc. 141. Physiology of Milk Secretion. (2)
Second semester. One lecture and one three-hour laboratory period per week. Prerequisite, Zoology 102 or 104. The anatomy and growth of the mammary gland and the metabolism and physiology of biosynthesis in the ruminant. (Williams.)

An. Sc. 142. Dairy Cattle Breeding. (3)
Second semester. Two lectures and one laboratory period per week. Prerequisites. Animal Science 40, Zoology 6, or Botany 117. A specialized course in breeding dairy cattle. Emphasis is placed on methods of evaluation and selection, systems and breeding and breeding programs.

An. Sc. S143. Advanced Dairy Production. (1)
Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents. It includes a study of the newer discoveries in dairy cattle nutrition, breeding and management. (Staff.)

For Graduates

An. Sc. 220. Advanced Breeding. (2)
See Animal Science for Description. (Green.)

An. Sc. 221. Energy and Protein Nutrition. (3)
See Animal Science for description. (Leffel and Combs.)

An. Sc. 240. Advanced Ruminant Nutrition. (2)
First semester. Two one-hour lectures and one. two-hour laboratory per week. Prerequisite. permission of department. Biochemical, physiological and bacteriological aspects of the nutrition of ruminants and other animals.
(Vandersall.)

An. Sc. 241. Research Methods. (3)
First semester. One lecture and two laboratory periods per week. Prerequisite, permission of instructor. The application of biochemical, physio-chemical and statistical methods to problems in biological research. (Keeney.)

An. Sc. 242. Experimental Mammalian Surgery I. (2)
First semester. Prerequisite. permission of instructor. A course presenting the fundamentals of anesthesia and the art of experimental surgery, especially to obtain research preparations. (Stewart.)

DAIRY PRODUCTION

For Graduates and Advanced Undergraduates

An. Sc. 109. Fundamentals of Nutrition. (3)
See Poultry Science for description. (Combs.)

An. Sc. 110. Applied Animal Nutrition. (3)
First semester. Two lectures and one laboratory period per week. Prerequisite. Math. 10. Animal Science 109 or permission of instructor. A critical study of those factors which influence the nutritional requirements of ruminants. swine and poultry. Practical feeding methods and procedures used in formulation of economically efficient rations will be presented. (Vandersall.)

An. Sc. 116. Anatomy of Domestic Animals. (3)
See Veterinary Science for description. (Brown.)

An. Sc. 117. Introduction to Diseases of Animals.
See Veterinary Science for description. (Brown.)

An. Sc. 118. Wildlife Management. (3)
See Animal Science for description. (Flyger.)

An. Sc. 130. Principles of Animal Breeding. (3)
See Animal Science for description. (Green.)

For Graduates

An. Sc. 243. Experimental Mammalian Surgery II. (3)
Second semester. Prerequisites. An. Sc. 242. permission of instructor. A course emphasizing advanced surgical practices to obtain research preparations. cardiovascular surgery and chronic vascularly isolated organ techniques. experience with pump oxygenator systems. profound hypothermia. hemodialysis. infusion systems. implantation and transplantation procedures are taught.
(Stewart.)

An. Sc. 260. Advanced Poultry Nutrition. (3)
See Poultry Science for description. (Combs.)

An. Sc. 261. Physiology of Reproduction. (3)
See Poultry Science for description. (Shaffner.)

An. Sc. 263. Poultry Nutrition Laboratory. (2)
See Poultry Science for description. (Creek.)

An. Sc. 264. Vitamins. (2)
See Poultry Science for description. (Combs.)

An. Sc. 265. Mineral Metabolism. (2)
See Poultry Science for description. (Creek.)

An. Sc. 301. Special Problems in Animal Science (1-3). (4 cr. max.)
First and second semesters. Prerequisite, approval of staff. Work assigned in proportion to amount of credit. Problems will be assigned which relate specifically to the character of work the student is pursuing. (Staff.)

An. Sc. 302. Seminar (1). (5 cr. max.)
First and second semesters. Students are required to prepare papers, based upon current scientific publications relating to Animal Science, or upon their research work, for presentation before and discussion by the class; (1) Recent advances; (2) Nutrition; (3) Physiology; (4) Biochemistry. (Staff.)

An. Sc. 399. Research. (1-12)
First and second semesters. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of animal science, carrying the same to completion, and report the results in the form of a thesis. (Staff.)

ECONOMICS

Professors: Dillard, Cumberland, Gruchy, O'Connell, Schultze (on leave), and Ulmer.

Associate Professors: Bergmann, Dodge, Knight, Weinstein, and Wonnacott.

Assistant Professors: J. Q. Adams, R. F. Adams, Bennett, Canterbery, Dorsey, Durant, Green, Hexter, Hinrichs, Kokat, Mayor, Meyer, and Snow.

Lecturers: Amuzegar, Bridges, Conrad, Gramley, Measday, Mueller, Pierce, and Spiegel.

master of arts. Requirements for the master's degree include (1) course work in economics as the Department deems appropriate in view of the candidates' previous training, (2) course work in a minor subject, (3) a thesis on a topic approved by the Department, and (4) a comprehensive

oral examination covering the major and the minor subjects and defense of the thesis.

DOCTOR OF PHILOSOPHY. The Ph.D. degree in economics is under the joint direction of the faculties of the Department of Economics and the Department of Business Administration. Before being advanced to candidacy doctoral students must pass comprehensive written and oral examinations in four of the following fields: (1) Accounting, (2) Comparative Economic Systems and Economic Planning, (3) Econometrics and Mathematical Economics, (4) Economic Development and History, (5) Economic Theory (required), (6) Financial Administration, (7) History of Economic Thought, (8) Industrial Administration, (9) Industrial Organization and Public Policy, (10) International Economics, (11) Labor Economics, (12) Marketing, (13) Money and Banking, (14) Public Finance and Fiscal Policy, (15) Regional Economics, (16) Statistics, (17) Transportation, (18) Any other field, including the minor, approved by the faculty. Students should consult with members of the faculty concerning the choice of fields and the choice of courses within these fields.

Econ. 211 and 212 (Quantitative Economics I and II, mathematics and statistics for economists) are required. Two graduate-level courses in economic thought are also required. If study equivalent to these required courses has been done elsewhere, this may be certified by passing the examinations in the courses with grades of "B" or better.

Further information concerning requirements and procedures may be obtained from the departments administering the program.

For Graduates and Advanced Undergraduates

ECON. 102. NATIONAL INCOME ANALYSIS. (3)

First and second semesters. Prerequisite, Econ. 32. An analysis of national income accounts and the level of national income and employment.

(Kokat, Mayor.)

ECON. 103. AMERICAN ECONOMIC DEVELOPMENT. (3)

Prerequisite, Econ. 32 or 37. A study of long-term trends in the American economy. The transplantation of economic institutions from Western Europe; the take-off period in United States economic growth; trends in productivity, prices, national income, savings and investment. The welfare state and the mixed economy.

ECON. 105. INTRODUCTION TO ECONOMIC DEVELOPMENT OF UNDERDEVELOPED AREAS. (3)

Prerequisite, Econ. 32 or 37. An analysis of the economic and social characteristics of underdeveloped areas. Recent theories of economic development; obstacles to development; policies and planning for development.

(J. Q. Adams, Bennett, Hinrichs.)

ECON. 106. ECONOMIC DEVELOPMENT OF SELECTED AREAS. (3)

Prerequisite. Econ. 105. Institutional characteristics of a specific area are discussed and alternative strategies and policies for development are analyzed.

(Bennett, Hinrichs.)

ECON. 130. MATHEMATICAL ECONOMICS. (3)

First semester. Prerequisites. Econ. 102 and 132 and one year of college mathematics. A course designed to enable economics majors to understand the simpler aspects of mathematical economics. Those parts of the calculus and algebra required for economic analysis will be presented.

(Ulmer, Hexter.)

ECON. 131. COMPARATIVE ECONOMIC SYSTEMS. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. An investigation of the theory and practice of various types of economic systems. The course begins with an examination and evaluation of the capitalistic system and is followed by an analysis of alternative types of economic systems such as fascism, socialism, and communism. (Gruchy, Dodge, Amuzagar.)

ECON. 132. INTERMEDIATE PRICE THEORY. (3)

First and second semesters. Prerequisite, Econ. 32. Required for economics majors; an analysis of price and distribution theory with special attention to recent developments in the theory of imperfect competition.

(Knight, Day.)

ECON. 134. CONTEMPORARY ECONOMIC THOUGHT. (3)

Prerequisites, Econ. 32 and senior standing. A survey of recent trends in American, English, and continental economic thought with special attention to the work of such economists as W. C. Mitchell, J. R. Commons, T. Veblen, W. Sombart, J. A. Hobson and other contributors to the development of economic thought since 1900. (Gruchy.)

ECON. 137. THE ECONOMICS OF NATIONAL PLANNING. (3)

Prerequisite, Econ. 32 or 37. An analysis of the principles and practice of economic planning with special reference to the planning problems of western European countries and the United States. (Gruchy.)

ECON. 138. ECONOMICS OF THE SOVIET UNION. (3)

Prerequisite, Econ. 32 or 37. An analysis of the organization, operating principles and performance of the Soviet economy with attention to the historical and ideological background, planning, resources, industry, agriculture, domestic and foreign trade, finance, labor, and the structure and growth of national income. (Dodge.)

ECON. 140. MONEY AND BANKING. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of the relation of money and credit to economic activity and prices; the impact of public policy in financial markets and in markets for goods and services; policies, structure, and functions of the Federal Reserve System; organization, operation, and functions of the commercial banking system, as related particularly to questions of economic stability and public policy.

(Bennett, Meyer, Staff.)

ECON. 141. THEORY OF MONEY, PRICES AND ECONOMIC ACTIVITY. (3)

Second semester. Prerequisite, Econ. 140. A theoretical treatment of the influence of money and financial markets on economic activity and prices, and of the effects of monetary policy on the markets for goods and services; the role of money in the classical and Keynesian macro-systems topics of theoretical interest in monetary policy formation and implementation. (Meyer.)

Econ. 142. Government Finance. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of the role of federal, state, and local governments in mobilizing resources to meet public wants: principles and policies of taxation, debt management, and government expenditures and their effects on resource allocation, stabilization of income and prices, income distribution and ecoomic growth.

(Dorsey, Durant, Hinrichs, Meyer.)

Econ. 143. Economics of Public Finance. (3)

Second semester. Prerequisite, Econ. 142 and 102, or consent of instructor. An economic analysis of the theory and practice of public finance including taxation, debt management, expenditures, and fiscal policy.

(Dorsey, Hinrichs.)

Econ. 144. State and Local Public Finance. (3)

Prerequisite, Econ. 32 or 37. Principles and problems of governmental finance with special reference to state and local jurisdiction. Topics to be covered include taxation, expenditures, and inter-governmental fiscal relations.

(R. F. Adams.)

Econ. 147. Business Cycles. (3)

First semester. Prerequisite, Econ. 32. A study of the causes of depressions and unemployment, cyclical and secular instability, theories of business cycles, and the problem of controlling economic instability. (Mayor.)

Econ. 148. International Economics. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A descriptive and theoretical analysis of international trade: balance of payments accounts; the mechanism of international economic adjustment; comparative costs; economics of customs unions. (Wonnacott, Canterbery.)

Econ. 149. International Economic Policies. (3)

Prerequisite, Econ. 148. Contemoprary balance of payments problems; the international liquidity controversy; investment, trade and economic development; evaluation of arguments for protection. (Wonnacott.)

Econ. 160. Labor Economics. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A survey of the structural and historical development and characteristics of labor. Theories of trade unions, bargaining and wages will be surveyed. Emphasis will be placed on the policy problems of labor in an industrial society. (Staff.)

Econ. 161. Problems in Labor Economics. (3)

Second semester. Prerequisite, Econ. 160. An intensive analysis of selected problems dealing with labor. Theoretical, historical and quantitative study of labor market and manpower problems in a developing and developed economy.

(Staff.)

Econ. 170. Industrial Organization. (3)

Prerequisite, Econ. 32 or 37. Changing structure of the American economy; price policies in different industrial classifications of monopoly and competition in relation to problems of public policy. (Snow.)

Econ. 171. Economics of American Industries. (3)

Prerequisite, Econ. 32 or 37. A study of the technology, economics and geography of twenty representative American industries. (Measday.)

For Graduates

Econ. 200. Micro-Economic Analysis. (3)

First semester. Prerequisite, Econ. 132. A critical analysis of the theory of economic decision-making in the firm, household, and industry in perfect and imperfect competition; price, output, distribution and the theory of general equilibrium. Review of recent contributions. (Ulmer, Weinstein.)

Econ. 201. Advanced Micro-Economic Analysis. (3)

Second semester. Prerequisite, Econ. 200 or consent of instructor. Continuation of Econ. 200 with particular attention to recent developments in linear programming, game theory, activity analysis, welfare economics, input-output analysis, aud micro-dynamic models. (Ulmer, Weinstein.)

Econ. 202. Macro-Economic Analysis. (3)

Second semester. Prerequisite, Econ. 102. National income accounting; determination of national income and employment especially as related to the modern theory of effective demand; consumption function; multiplier and acceleration principles; the role of money as it affects output and employment as a whole. (Schultze, Bergmann.)

Econ. 203. Seminar in American Economic Development. (3)

Prerequisite, Graduate standing. Selected topics in the long-term movements of the American economy.

Econ. 204. Origins and Development of Capitalism. (3)

Study of the transition from feudalism to capitalism and the subsequent development of leading capitalist institutions in industry, agriculture, commerce, banking, and the social movement. (Dillard.)

Econ. 205. Economic Development of Underdeveloped Areas. (3)

First semester. Prerequisite, Econ. 102 and 132. Principles and problems of economic developments in underdeveloped areas; policies and techniques which hasten economic development. (Bennett.)

Econ. 206. Seminar in Economic Development. (3)

Second semester. Prerequisite, Econ. 205 or consent of instructor. Problems and policies of economic development in specified underdeveloped areas. (Bennett.)

Econ. 207. Money and Finance in Economic Development. (3)

Prerequisite, Econ. 205 or consent of instructor. An analysis of alternative methods of financing investment during the process of economic development. (Hinrichs, Bennett.)

Econ. 211. Quantitative Economics I. (3)

Required of all Ph.D. majors in economics. Elements of the theory and practice of statistical inference. Tests of hypotheses, characteristics of estimates.

and the measurement of relationships between variable are introduced, with applications to problems of empirical economic research. (Green, Hexter.)

Econ. 212. Quantitative Economics II. (3)

Prerequisite, Econ. 211 or equivalent. Required of all Ph.D. majors in economics. Multiple regression, correlation, analysis of variance and analysis of covariance are among the topics discussed. Applications to empirical economic research will be stressed. (Bergmann, Green.)

Econ. 214. Advanced Mathematical Economics. (3)

Second semester. Prerequisite, either one year of calculus or Econ. 211. Model-building and mathematical derivation of micro- and macro-economic theories. Further topics in differential and difference equations and in matrix algebra introduced as required. (Ulmer.)

Econ. 217. Econometrics I. (3)

Prerequisite, Econ. 212. Advanced theory and applications of quantitative economic research, with emphasis on estimation of simultaneous equation systems. (Green, Hexter.)

Econ. 218. Econometrics II. (3)

Prerequisite, Econ. 212 or the equivalent. Seminar in the application of quantitative methods. (Green.)

Econ. 220. Regional Analysis and Location Theory. (3)

Prerequisite, Graduate standing or permission of the instructor. Location theory and the spatial distribution of economic activity. The application to regional and interregional problems of analytic methods, such as input-output techniques, linear programming, social accounts, gravity models, industrial complex analysis, money flows, and balance of payments. (Staff.)

Econ. 230. History of Economic Thought. (3)

First semester. Prerequisite, Econ. 132 or consent of the instructor. A study of the development of economic thought and theories including the Greeks, Romans, canonists, mercantilists, physiocrats, Adam Smith, Malthus, Ricardo. Relation of ideas to economic policy. (Dillard, Spiegel.)

Econ. 231. Economic Theory in the Nineteenth Century. (3)

Second semester. Prerequisite, Econ. 230 or consent of the instructor. A study of various nineteenth and twentieth century schools of economic thought, particularly the classicists, neo-classicists. Austrians, German historical school, American economic thought and the socialists. (Dillard.)

Econ. 232, 233. Seminar in Institutional Economic Theory. (3, 3)

A study of recent developments in the field of institutional economic theory in the United States and abroad. (Gruchy.)

Econ. 234. Economic Growth in Mature Economies. (3)

Analysis of policies and problems for achieving stable economic growth in mature economies such as the United States, the United Kingdom, and the Scandinavian countries. (Gruchy.)

Econ. 235. Advanced International Economics. (3)

First semester. General equilibrium and disequilibrium in the world economy; international mechanism and adjustment; price, exchange rate, and income changes. Commercial policy and the theory of customs unions.
(Wonnacott.)

Econ. 236. Seminar in International Economic Relations. (3)

Second semester. A study of selected problems in international economic relations. (Wonnacott.)

Econ. 237. Selected Topics in Economics. (3)

Econ. 238. Seminar in Economic Development of the Soviet Union. (3)

Prerequisite, Econ. 138 or consent of instructor. Measurement and evaluation of Soviet economic development including interpretation and use of Soviet statistics, measurement of national income and rates of growth, fiscal and monetary policies, investment and technological change, planning and economic administration, manpower and wage policies, foreign trade and aid, and selected topics in Bloc development. (Dodge.)

Econ. 240. Monetary Theory and Policy. (3)

First semester. An adequate knowledge of micro- and macro-economics is assumed. Theory of money, financial assets, and economic activity; review of classical, neo-classical and Keynesian contributions; emphasis on post-Keynesian contributions, including those of Tobin, Patinkin, Gurley-Shaw, Friedman, and others. (Gramley.)

Econ. 241. Seminar in Monetary Theory and Policy. (3)

Second semester. Prerequisite, Econ. 240 or consent of instructor. Theory of the mechanisms through which central banking affects economic activity and prices; formation and implementation of monetary policy; theoretical topics in monetary policy. (Gramley.)

Econ. 242. Advanced Theory of Public Finance. (3)

First semester. Prerequisite, Econ. 143 or conesent of instructor. Theories of taxation, debt management, and fiscal policy. Students are assumed to have a working knowledge of micro- and macro-economic analysis.
(Hinrichs, Dorsey.)

Econ. 243. Seminar in Public Finance. (3)

Second semester. Prerequisite, Econ. 242. Theory of public expenditures with special attention to recent contributions; economic analysis of the theory and practice of public finance in various settings. (Schultze, Dorsey, Hinrichs.)

Econ. 247. Economic Growth and Instability. (3)

Second semester. An analytical study of long-term economic growth in relation to short-term cyclical instability. Attention is concentrated on the connection between accumulation of capital and the capital requirements of secular growth and business cycles. Earlier writings as well as recent growth models are considered. (Schultze, Mayor.)

Econ. 248. The Economics of Technical Change. (3)

Prerequisite, consent of instructor. A study of the determinants and impact of inventions and innovations. Attention is given to the qualitative and quantitative aspects of technical change, both at the micro-economic and macro-economic levels, and under different conditions of economic development.

Econ. 260. Seminar in Labor Economics. (3)

Prerequisite. Econ. 160 or consent of instructor. A study of wage theory and human capital theory as the primary basis for analysis of absolute and relative wages. An appraisal of theoretical and quantitative tools in the study of labor. (Knight, Weinstein.)

Econ. 261. Selected Topics in Labor Economics. (3)

Prerequisite. Econ. 160 or consent of instructor. An analytical investigation of problems and policy areas in labor economics. Inter-relations of labor and other markets, unemployment and manpower. Specific treatment of manpower problems, unemployment and labor force analysis.
(Knight, Weinstein.)

EDUCATION

Professors: V. E. Anderson, Blough, Byrne, Duffey, Gerberich, Grentzer, Harrison, Hornbake, Hovet, Hymes, Kurtz, Leeper, Magoon, Maley, Mayor, McClure, Mershon, Morgan, Newell, O'Neill, Patrick, Perkins, Prescott, Risinger, Schindler, Thompson, vanZwoll, Waetjen, and Wiggin.

Associate Professors: Adkins, J. P. Anderson, Bowie, Bryan, Chapin, Dunham, Giblette, Goering, Grambs, Hebeler, James, Kelsey, Lemmon, Lockard, Luetkemeyer, Marx, Neville, Raths, Spencer, Stunkard, Tierney, Wedberg, and Wilson.

Assistant Professors: Agre, Ashlock, Bott, Crosby, Dayton, DiLavore, Dudley, Edgemon, Finkelstein, Fitch, Frank, Funaro, Gessner, Greenberg, Hall, Hamby, Hatfield, Henkelman, Herman, Huber, Kelly, Klevan, Kyle, Larson, Lawrence, Lawson, Lindsay, Longley, Matteson, Merrill, Milhollan, Noll, Pfau, Ray, Renz, Rhoads, Rishel, Rodgers, Scarr, Seidman, Simms, Sullivan, Walbesser, Williams, and Zachary.

Master of Arts and Master of Education

Advanced Graduate Specialist in Education

Doctor of Philosophy and Doctor of Education

Programs in a variety of educational specialities are offered through three levels of degree and diploma programs. In consultation with an adviser, a student may choose at the first level, to qualify for the degree of Master of Arts or Master of Education. A high degree of professional competence is

required for the Advanced Graduate Specialist diploma at the second level but in a separate stream from the degree programs. Both the Doctor of Education and the Doctor of Philosophy degrees are offered at the third level. The master's and doctoral degrees come under the jurisdiction of the Graduate School. For the AGS diploma, a student must be matriculated in the Graduate School but the program is under the control of the College of Education.

During the first semester of graduate work, the student is required to take a test battery, at a fee of $5.00, and to submit professional recommendations.

MAJOR AREAS

Following is a list of major areas. Note that some majors can be pursued only at the master's level, whereas others are primarily AGS or doctoral programs. *For policies and procedures respecting all degree and diploma programs, see bulletins issued by the Department of Education.*

- Adult Education
- Business Education
- Corrective and Remedial Reading
- *Curriculum and Instruction
- *Educational Administration and Supervision
  - General
  - Elementary
  - Secondary
- *Elementary Education
- **Higher Education
- *History and Philosophy of Education and Comparative Education
- *Home Economics Education
- *Human Development Education
- *Industrial Education
  - *Industrial Arts
  - Education for Industry
  - *Vocational-Industrial
- *Music Education
- *Personnel Services
  - Community Counseling
  - *School Counseling
    - Elementary
    - Secondary
  - *Student Personnel Administration
  - Visiting Teacher
  - Vocational Rehabilitation Counseling
- *Research Design, Statistics, Measurement
- *Secondary Education
  - Art
  - *English
  - Foreign Language
  - *Mathematics
  - *Science
  - *Social Studies
- *Special Education
  - Emotional Disturbance
  - Gifted
  - Mental Retardation
  - Perceptual Disturbance

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*Starred items indicate majors in which there are doctoral programs. Note that there are also master's and for the most part AGS programs in most of these areas. Unstarred items indicate majors at the master's and/or AGS levels only.

**Higher Education is a doctoral area in combination with some other area of Education.

GENERAL EDUCATION

For Graduates and Advanced Undergraduates

ED. 100. HISTORY OF EDUCATION IN WESTERN CIVILIZATION. (3)

Educational institutions through the ancient, mediaeval, and early modern periods in the western civilization, as seen against a background of socio-economic development. (Lindsay.)

ED. 102. HISTORY OF EDUCATION IN THE UNITED STATES. (3)

A study of the origin and development of the chief features of the present system of education in the United States. (Wiggin.)

ED. 107. PHILOSOPHY OF EDUCATION. (2-3)

A study of the great educational philosophers and systems of thought affecting the development of modern education. (Agre,Noll.)

ED. 108. LOGIC OF TEACHING. (3)

An analysis of the structure of basic subject matters in the curriculum and of the standard logical moves in teaching. (Agre.)

ED. 147. AUDIO-VISUAL EDUCATION. (3)

First semester and summer session. Laboratory fee, $1.00. Sensory impressions in their relation to learning; projection apparatus, its cost and operation; slides, film-strips, and films; physical principles underlying projection; auditory aids to instruction; field trips; pictures, models, and graphic materials; integration of sensory aids with organized instruction. Recommended for all education students. (Herrick, Maley, Schramm.)

ED. 150. EDUCATIONAL MEASUREMENT. (3)

First and second semesters and summer session. Constructing and interpreting measures of achievement. (Staff.)

ED. 151. STATISTICAL METHODS IN EDUCATION. (3)

Designed as a first course in statistics for students in education. Emphasis is upon educational applications of descriptive statistics, including measures of central tendency, variability, and association. (Staff.)

ED. 155. LABORATORY PRACTICES IN READING. (2-4)

Prerequisite, Ed. 153 or Ed. 157. A laboratory course in which each student has one or more pupils for analysis and instruction. At least one class meeting per week to diagnose individual cases and to plan instruction.
(Hall, Sullivan, Wilson.)

ED. 157. CORRECTIVE-REMEDIAL READING INSTRUCTION. (3)

Prerequisite. Ed. 153 or equivalent. For teachers, supervisors, and administrators who wish to identify and assist pupils with reading difficulties. Concerned with diagnostic techniques, instructional materials, and teaching procedures useful in the regular classroom. (Hall, Sullivan, Wilson.)

ED. 160. EDUCATIONAL SOCIOLOGY. (3)

Deals with data of the social sciences which are germane to the work of teachers. Implications of democratic ideology for educational endeavor, educational tasks imposed by changes in population and technological trends, the welfare status of pupils, the socio-economic attitudes of individuals who control the schools, and other elements of community background. (Grambs.)

ED. 161. INTRODUCTION TO COUNSELING AND PUPIL SERVICES. (3)

Presents guidance principles and procedures, and examines the functions of counselors, psychologists in schools, school social workers, and other pupil service workers. (Staff.)

ED. 162. MENTAL HYGIENE IN THE CLASSROOM. (3)

The practical application of the principles of mental hygiene to classroom problems. (Greenberg.)

ED. 182. INTRODUCTION TO REHABILITATION COUNSELING. (3)

Introductory course for majors in rehabilitation counseling, social work, psychology or education who desire to work professionally with physically or emotionally handicapped persons. (Ehrle, Lawrence.)

ED. 185. PUPIL TRANSPORTATION. (2)

Includes consideration of the organization and administration of state, county, and district pupil transportation service with emphasis on safety and economy. The planning of bus routes; the selection and training of bus drivers, and maintenance mechanics; the specification of school buses; and procurement procedures are included. (Staff.)

ED. 187. FIELD EXPERIENCE IN EDUCATION. (1-4)

a. Adult Education
b. Counseling
c. Curriculum and Instruction
d. Educational Administration
e. Higher Education
f. Industrial Arts Education
g. Student Personnel Administration
h. Supervision
i. Vocational-Industrial Education

Prerequisites, at least six semester hours in education at the University of Maryland plus such other prerequisites as may be set by the major area in which the experience is to be taken. Planned field experience may be provided for selected graduate students who have had teaching experience and whose application for such field experience has been approved by the education faculty. Field experience is offered in a given area to both major and nonmajor students. (Staff.)

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours.

ED. 188. SPECIAL PROBLEMS IN EDUCATION. (1-3)

Prerequisite, consent of instructor. Available only to mature students who have definite plans for individual study of approved problems. *Course cards must have the title of the problem and the name of the faculty member who has approved it.* (Staff.)

ED. 189. WORKSHOPS, CLINICS, AND INSTITUTES. (1-6)

The maximum number of credits that may be earned under this course symbol toward any degree is six semester hours, the symbol may be used two or more times until six semester hours have been reached.

The following types of educational enterprises may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in

the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy, laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals, and supervisors. (Staff.)

For Graduates

ED. 202. THE JUNIOR COLLEGE. (2)

The philosophy and development of the junior college in the United States with emphasis on curriculum and administrative controls. Special attention is devoted to the importance, need, place and development of technical-terminal curricula. (Kelsey.)

ED. 203. PROBLEMS IN HIGHER EDUCATION. (3)

A study of present problems in higher education. (Kelsey.)

ED. 205. COMPARATIVE EDUCATION. (3)

A study of historical changes in ways of looking at national school systems, and of problems in assessing their effectiveness. (Lindsay, Wiggin.)

ED. 206. SEMINAR IN COMPARATIVE EDUCATION. (2)

(Lindsay, Wiggin.)

ED. 207. SEMINAR IN HISTORY AND PHILOSOPHY OF EDUCATION. (2)

(Noll, Wiggin.)

ED. 208. ANALYSIS OF EDUCATIONAL CONCEPTS. (3)

Application of techniques of conceptual analysis to select concepts in education. Mental health, adjustment, creativity, and understanding are among the concepts considered. (Agre.)

ED. 209. ADULT EDUCATION. (3)

A study of adult education in the United States, with attention to adult abilities and intelligence, programs of adult education, and a rationale for adult education.

ED. 210. THE ORGANIZATION AND ADMINISTRATION OF PUBLIC EDUCATION. (3)

The basic course in school administration. Deals with the organization and administration of school systems—at the local, state and federal levels; and with the administrative relationships involved. (Dudley, Newell, van Zwoll.)

ED. 211. THE ORGANIZATION AND ADMINISTRATION OF SECONDARY SCHOOLS. (3)

The work of the secondary school principal. Includes topics such as personnel problems, school-community relationships, student activities, schedule making, and internal financial accounting. (J. P. Anderson.)

ED. 212. SCHOOL FINANCE AND BUSINESS ADMINISTRATION. (3)

An introduction to principles and practices in the administration of the public school finance activity. Sources of tax revenue, the budget, and the function of finance in the educational program are considered. (van Zwoll.)

ED. 214. SCHOOL PLANT PLANNING. (2-3)

An orientation course in which the planning of school buildings is developed as educational designing with reference to problems of site, building facilities, and equipment. (van Zwoll.)

ED. 216. PUBLIC SCHOOL SUPERVISION. (3)

The nature and functions of supervision; various supervisory techniques and procedures; human relationship factors; and personal qualities for supervisor. (J. P. Anderson, Dudley, Neville).

ED. 217. ADMINISTRATION AND SUPERVISION IN ELEMENTARY SCHOOLS. (3)

Problems in administering elementary schools and improving instruction. (Dudley.)

ED. 218. SCHOOL SURVEYS. (2-6)

Prerequisite, consent of instructor. Includes study of school surveys with emphasis on problems of school organization and administration, finance and school plant planning. Field work in school surveys is required. (Newell.)

ED. 219. SEMINAR IN EDUCATIONAL ADMINISTRATION AND SUPERVISION. (2-4)

Prerequisite, at least four hours in educational administration and supervision or consent of instructor. A student may register for two hours and may take the seminar a second time for an additional two hours. (Staff.)

ED. 221. ADVANCED SCHOOL PLANT PLANNING. (2)

Ed. 214 is a prerequisite to this course. However, students with necessary background may be admitted without completion of Ed. 214. This is an advanced course in school plant planning problems. Emphasis is given to analysis of the educational program and planning of physical facilities to accommodate that program. (van Zwoll.)

ED. 223. PRACTICUM IN PERSONNEL RELATIONSHIPS. (2-6)

Prerequisite, consent of instructor. Enrollment limited. Designed to help teachers, school administrators, and other school staff members to learn to function more effectively in developing educational policy in group situations. Each student in the course is required to be working concurrently in the field with a group of school staff members or citizens on actual school problems. (Newell.)

ED. 224. APPRENTICESHIP IN EDUCATION. (6-9)

a. Counseling
b. Curriculum and Instruction
c. Educational Administration
d. Industrial Arts Education
e. Student Personnel Administration
f. Supervision
g. Vocational-Industrial Education

Apprenticeships in the major area of study are available to selected students whose application for an apprenticeship has been approved by the Education faculty. Each apprentice is assigned to work for at least a semester full-time or the equivalent with an appropriate staff member of a cooperating school, school system, or educational institution or agency. The sponsor of the apprentice maintains a close working relationship with the apprentice and the other

persons involved. Prerequisites, teaching experience, a master's degree in education, and at least six semester hours in education at the University of Maryland. (Staff.)

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours.

ED. 225. SCHOOL PUBLIC RELATIONS. (3)

A study of the interrelationships between the community and the school. Public opinion, propaganda, and the ways in which various specified agents and agencies within the school have a part in the school public relations program are explored. (van Zwoll.)

ED. 226. CHILD ACCOUNTING. (2)

An inquiry into the record keeping activities of the school system, including an examination of the marking system. (van Zwoll.)

ED. 227. PUBLIC SCHOOL PERSONNEL ADMINISTRATION. (3)

A comparison of practices with principles governing the satisfaction of school personnel needs, including a study of tenure, salary schedules, supervision, rewards, and other benefits. (van Zwoll.)

ED. 228. INTRODUCTION TO STUDENT PERSONNEL. (2)

Prerequisite, consent of instructor. (Same as Psych. 228.) A systematic analysis of research and theoretical literature on a variety of major problems in the organization and administration of student personnel services in higher education. Included will be discussion of such topics as the student personnel philosophy in education, counseling services, discipline, housing, student activities, financial aid, health, remedial services, etc. (Rishel, Marx.)

ED. 234. THE SCHOOL CURRICULUM. (2-3)

A foundations course embracing the curriculum as a whole from early childhood through adolesence, including a review of historical developments, an analysis of conditions affecting curriculum change, an examination of issues in curriculum making, and a consideration of current trends in curriculum design. (Hovet.)

ED. 235. PRINCIPLES OF CURRICULUM DEVELOPMENT. (3)

Curriculum planning, improvement, and evaluation in the schools; principles for the selection and organization of the content and learning experiences; ways of working in classroom and school on curriculum improvement. (V. Anderson, Neville.)

ED. 237. CURRICULUM THEORY AND RESEARCH. (2)

The school curriculum considered within the totality of factors affecting pupil behavior patterns, an analysis of research contributing to the development of curriculum theory, a study of curriculum theory as basic to improved curriculum design, the function of theory in guiding research, and the construction of theory, through the utilization of concepts from the behavioral research disciplines. (Hovet.)

Ed. 241. Problems in the Teaching of Reading. (3)

A. Elementary Schools

B. Secondary Schools

Prerequisite: Ed. 153 or equivalent. Implications of current theory and the results of research for the teaching of reading. Attention is given to all areas of development reading instruction, with special emphasis on persistent problems. (Hall, Sullivan, Wilson.)

Ed. 242. Coordination in Work-Experience Programs. (2)

Surveys and evaluates the qualifications and duties of a teacher-coordinator in a work-experience program. Deals particularly with evolving patterns in city and country schools in Maryland, and is designed to help teacher-coordinators, guidance counselors, and others in the supervisory and administrative personnel concerned with functioning relationships of part-time cooperative education in a comprehensive educational program. (Merrill.)

Ed. 245. Introduction to Research. (2)

Intensive reading, analysis, and interpretation of research; applications to teaching fields; the writing of abstracts, research reports, and seminar papers. (Staff.)

Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(See Ind. Ed. 248) (Maley.)

Ed. 249. Personality Theories in Education. (3)

Prerequisite, consent of instructor. Examination of constructs and research relating to major personality theories with emphasis on their significance for educators working with the behavior of individuals in school settings. (Greenberg.)

Ed. 250. Cases in Pupil Appraisal. (3)

Prerequisite, Ed. 262. Collecting and interpreting non-standardized pupil appraisal data; synthesis of all types of data through case study procedures. (Ray, Rhoads.)

Ed. 251. Intermediate Statistics in Education. (3)

Prerequisite, Ed. 151 or equivalent. A study of the basic statistical techniques used for graduate research in education, including tests of significance and sampling techniques. Necessary arithmetic skills are developed as part of the course. (Staff.)

Ed. 253. Occupational Choice: Theory and Information. (3)

Prerequisite, Ed. 161. Research and theory related to occupational and educational decisions; school programs of related information and other activities in occupational decisions. (Byrne, Rhoads.)

Ed. 254. Organization and Administration of Pupil Services. (2)

Prerequisite, Ed. 261 or permission of instructor. Instilling the guidance point of view and implementing guidance practices. (Greenberg.)

Ed. 255, 256. Advanced Laboratory Experiences in Reading Instruction. (3, 3)

Prerequisites, at least 21 credits applicable to the master's program in Corrective and Remedial Reading. The first semester of the course deals with diagnostic techniques. Each participant will assist in diagnosing reading disabilities and in recommending instructional programs for individual pupils. The second semester deals with instruction of pupils with reading disabilities. Each participant will plan and execute a program of instruction for an individual or a small group, applying findings of the preliminary diagnosis.

(Hall, Sullivan, Wilson.)

Ed. 257. Diagnosis and Remediation of Reading Disabilities. (3)

Prerequisites, ECEED 153 and Ed. 157. For those who wish to become corrective and remedial reading speialists. Concerned with clinical techniques, instructional materials, and remedial procedures useful to the reading specialist in (1) diagnosing serious reading difficulties and (2) planning programs of individual and small-group instruction. The work includes the writing of diagnostic and progress reports. (Hall, Sullivan, Wilson.)

Ed. 259. Counseling in the Elementary School. (3)

Prerequisite, Ed. 250 or consent of instructor. Counseling theory and practices as related to children. Emphasis will be placed on an awareness of the child's total behavior as well as on specific methods of communicating with the child through techniques of play interviews, observations, and the use of non-parametric data. (Greenberg.)

Ed. 260. School Counseling: Theoretical Foundations and Practice. (3)

Prerequisites, Ed. 161, 250, 253. Exploration of learning theories as applied to counseling in schools, and practices which stem from such theories.

(Staff.)

Ed. 261. Practicum in Counseling. (2-6)

Prerequisites, Ed. 260 and permission of instructor. Sequence of supervised counseling experiences of increasing complexity. Limited to 8 applicants in advance. Laboratory. (Staff.)

Ed. 262. Measurement in Pupil Appraisal. (3)

Prerequisite, Ed. 150. Study of group tests typically employed in school testing programs; discussion of evidence relating to the measurement of abilities. (Staff.)

Ed. 265. Theory of Measurement. (2)

Prerequisites, Ed. 150 and Ed. 151. Treats such topics as theory and techniques used in various scaling methods, test analysis, predictive accuracy of scores, and equivalence of scores. For students desiring more advanced treatment of problems. (Giblette.)

Ed. 269. Counseling and Pupil Services Seminar (2)

Enrollment by permission of instructor. (Marx.)

ED. 271. ADVANCED STATISTICS IN EDUCATION. (3)

Prerequisite, Ed. 251 or equivalent. Primarily for the education student desiring more advanced work in statistical methodology. Survey of major types of statistical design in educational research; application of multivariate statistical techniques to educational problems. (Dayton, Stunkard.)

ED. 275, 276. ADVANCED PROBLEMS IN ART EDUCATION. (3, 3)

These courses are centered about problems of teaching art in the elementary and secondary schools in terms of the philosophy of art education today, techniques and processes in the visual arts, and creative opportunities in the visual arts and in art education. The student also will have the opportunity to do special work centered about his problems in art education. (Staff.)

ED. 279. SEMINAR IN ADULT EDUCATION. (2)

ED. 280. RESEARCH METHODS AND MATERIALS. (2)

Research methodology for case studies, surveys, and experiments; measurements and statistical techniques; design, form and style for theses and research reports. Primarily for advanced students and doctoral candidates. (Stunkard.)

ED. 281. SOURCE MATERIALS IN EDUCATION. (2)

Bibliography development through a study of source materials in education, special fields in education, and for seminar papers and theses. (Wiggin.)

ED. 283. PSYCHO-SOCIAL ASPECTS OF DISABILITY. (3)

Prerequisite, Ed. 182 or consent of instructor. This course is part of the core curriculum for rehabilitation counselors. It is designed to develop an understanding of the nature and importance of the personal and psycho-social aspects of adult disability. (Ehrle.)

ED. 284, 285. MEDICAL ASPECTS OF DISABILITY I & II. (3, 3)

Prerequisite, Ed. 182 or consent of instructor. Part of the core curriculum for rehabilitation counselors. It is designed to develop an understanding of the prognosis and complications of disease processes and disorders and a knowledge of treatment measures so that realistic vocational rehabilitation goals may be developed. (Gessner.)

ED. 287. INTERNSHIP IN EDUCATION. (12-16)

a. Curriculum and Instruction
b. Educational Administration
c. Industrial Arts Education
d. Pupil Personnel Services
e. Student Personnel Services
f. Supervision
g. Vocational-Industrial Education

Internships in the major area of study are available to selected students who have teaching experience. The following groups of students are eligible: (a) any student who has been advanced to candidacy for the doctor's degree; and (b) any student who receives special approval by the education faculty for an internship, provided that prior to taking an internship, such student shall have completed at least sixty semester hours of graduate work, including at least six semester hours in education at the University of Maryland. Each intern is assigned to work on a full-time basis for at least a semester with an appropriate staff member in a cooperating school, school system, or educa-

tional institution or agency. The internship must be taken in a school situation different from the one where the student is regularly employed. The intern's sponsor maintains a close working relationship with the intern and the other persons involved.

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours. (Staff.)

ED. 288. SPECIAL PROBLEMS IN EDUCATION. (1-6)

Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisers may register for credit under this number. *Course card must have the title of the problem and the name of the faculty member under whom the work will be done.* (Staff.)

ED. 290. DOCTORAL SEMINAR. (1-3)

Prerequisite, passing the preliminary examinations for a doctor's degree in education, or recommendation of a doctoral adviser. Analysis of doctoral projects and theses, and of other on-going research projects. A doctoral candidate may participate in the Seminar during as many University sessions as he desires, but may earn no more than three semester hours of credit in the Seminar. An Ed.D. candidate may earn in total no more than nine semester hours, and a Ph.D candidate, no more than eighteen semester hours, in the Seminar and in Ed. 399. (Dayton, Hovet, Stunkard.)

ED. 302. CURRICULUM IN HIGHER EDUCATION. (3)

An analysis of research in curriculum and of conditions affecting curriculum change, with examination of issues in curriculum making based upon the history of higher education curriculum development. (Kelsey.)

ED. 303. ORGANIZATION AND ADMINISTRATION OF HIGHER EDUCATION. (2)

Organization and administration of higher education at the local, state, and federal levels; and an analysis of administrative relationships and functions and their effects on curriculum and instruction. (Kelsey, Wiggin.)

ED. 304. STUDENT PERSONNEL AND THE COLLEGE STUDENT. (2)

A demographic study of the characteristics of college students; as well as a study of their aspirations, values, and purposes. (Bott.)

ED. 305. COLLEGE TEACHING. (3)

Various methods of college instruction analyzed in relation to the curriculum and psychological basis. These would include the case study method, the demonstration method, the lecture method, the recitation method, teaching machines, teaching by television, and other teaching aids. (Kelsey and Staff.)

ED. 309. SEMINAR IN PROBLEMS OF HIGHER EDUCATION. (2)

(Kelsey.)

ED. 310. SEMINAR IN STUDENT PERSONNEL. (2-6)

An intensive study of the various student personnel functions. A means to integrate the knowledges from various fields as they relate to student personnel administration. (Marx, Rishel.)

ED. 399. RESEARCH. (Credit variable)

Registration required to the extent of 6 hours for master's thesis; 6-9 hours for a doctoral project; and 12-18 hours for a doctoral dissertation. (Staff.)

EARLY CHILDHOOD-ELEMENTARY EDUCATION[1]

For Advanced Undergraduates and Graduates

ECEED. 105. SCIENCE IN THE ELEMENTARY SCHOOL. (2-3)

A. Early Childhood. B. Elementary. Laboratory fee, $2.00. Designed to help teachers acquire general science understandings, and to develop teaching materials for practical use in classrooms. Includes experiments, demonstrations, constructions, observations, field trips, and use of audio-visual materials. The emphasis is on content and method related to science units in common use in elementary schools. (Blough, Williams.)

ECEED. 115. ACTIVITIES AND MATERIALS IN EARLY CHILDHOOD EDUCATION. (3)

Prerequisite, H. D. Ed. 110 (or concurrent enrollment). Laboratory fee, $5.00. Storytelling; selection of books; the use, preparation, and presentation of such raw materials as clay, paint (easel and finger), blocks, wood, and scrap materials. (Stant.)

ECEED. 116. MUSIC IN EARLY CHILDHOOD EDUCATION. (3)

First and second semesters. Prerequisite, Music 16 or equivalent. Creative experiences in songs and rhythms; correlation of music and everyday teaching with the abilities and developments of each level; study of songs and materials; observation and teaching experience with each age level. (L. Brown.)

ECEED. 121. LANGUAGE ARTS IN THE ELEMENTARY SCHOOL. (2-3)

A. Early Childhood. B. Elementary. Teaching of spelling, handwriting, oral and written expression, and creative expression. Special emphasis given to skills having real significance to pupils. (Edgemon, Leeper, Zachary.)

ECEED. 122. SOCIAL STUDIES IN THE ELEMENTARY SCHOOL. (2-3)

A. Early Childhood. B. Elementary. Consideration given to curriculum, organization and methods of teaching, evaluation of newer materials, and utilization of environmental resources. (O'Neill, Weaver, Duffey, Herman.)

ECEED. 123. THE CHILD AND THE CURRICULUM. (2-3)

A. Early Childhood. B. Elementary. Relationship of the elementary school curriculum to child growth and development. Recent trends in curriculum organization; the effect of environment on learning; readiness to learn; and adapting curriculum content and methods to maturity levels of children. (Seidman, Leeper.)

ECEED. 124. MATHEMATICS IN THE ELEMENTARY SCHOOL. (2-3)

A. Early Childhood. B. Elementary. Emphasis on materials and procedures which help pupils sense arithmetical meanings and relationships. Helps teachers gain a better understanding of the number system and arithmetical processes. (Schindler, Ashlock.)

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[1] For additional courses in reading see listings under Education.

ECEEd. 125. Art in Elementary Shcool. (2)

Concerned with art methods and materials for elementary schools. Includes laboratory experiences with materials appropriate for elementary schools. (Lembach, Longley.)

ECEEd. 152. Literature for Children and Young People, Advanced. (3)

Prerequisite, Ed. 52, or approval of instructor. Development of literary materials for children and young people. Timeless and ageless books, and outstanding examples of contemporary publishing. Evaluation of the contributions of individual authors and illustrators and children's book awards. Study and practice in story-telling, and reading guidance in the classroom and library. (D. Brown, E. Anderson, Hall, Pfau.)

ECEEd. 153. The Teaching of Reading. (2-3)

A. Early Childhood. B. Elementary. C. Secondary. Concerned with the fundamentals of developmental reading instruction, including reading readiness, use of experience records, procedures in using basal readers, the improvement of comprehension, teaching reading in all areas of the curriculum, uses of children's literature, the program in word analysis, and procedures for determining individual needs. (Edgemon, Hall, Herman, Pfau, Zachary.)

ECEEd. 160. Teacher-Parent Relationships. (2-3)

A survey of child development, child guidance, and related fields; a review of current materials, books, periodicals, leaflets, films, skits; study of individual parent conferences; guided observation; discussion leading, role playing, preparing materials and programs for parent groups, and television skits with laboratory practice through the group itself. (Hymes.)

For Graduates

ECEEd. 200. Seminar in Elementary Education. (2)

Primarily for individuals who wish to write seminar papers. (Staff.)

ECEEDd. 205. Problems of Teaching Science in Elementary Schools. (2)

An opportunity to pursue special problems in curriculum making, course of study development, or other science teaching problems. Class members may work on problems related directly to their own school situations. (Blough, Williams.)

ECEEd. 221. Problems of Teaching Language Arts in Elementary Schools. (2)

Implications of current theory and results of research for the language arts in the elementary schools. (Edgemon, Leeper, Zachary.)

ECEEd. 222. Problems of Teaching Social Studies in Elementary Schools. (2)

Application to the social studies program of selected theory and research in the social sciences, emphasizing patterns of behavior, environmental influences, and critical thinking. (O'Neill, Weaver, Duffey.)

ECEEd. 224. PROBLEMS OF TEACHING MATHEMATICS IN ELEMENTARY SCHOOLS. (2)

Implications of theory and results of research for the teaching of arithmetic in the elementary schools. (Schindler, Ashlock.)

HUMAN DEVELOPMENT EDUCATION

For Graduates and Advanced Undergraduates

H. D. ED. 102, 103, 104. CHILD DEVELOPMENT LABORATORY I, II AND III. (2, 2, 2)

These courses involve the direct study of children throughout the school year. Each participant gathers a wide body of information about an individual. presents the accumulating data from time to time to the study group for criticism and group analysis and writes an interpretation of the dynamics underlying the child's learning, behavior and development. Provides opportunity for teachers in-service to earn credit for participation in their own local child study group. (Staff.)

H. D. ED. 105. ADOLESCENT DEVELOPMENT. (3)

A study of the interplay of physical, cultural and self forces as they influence behavior, development, learning, and adjustment during adolescence. Includes observation and case study. *This course cannot be used to meet the psychological foundation requirements for teacher certification.*

H. D. ED. 112, 114, 116. SCIENTIFIC CONCEPTS IN HUMAN DEVELOPMENT I, II AND III. (3, 3, 3)

Summer session. (Staff.)

H. D. ED. 113, 115, 117. LABORATORY IN BEHAVIOR ANALYSIS I, II AND III. (3, 3, 3)

Summer session. (Staff.)

H. D. ED. 120, 121, 122. STUDY OF HUMAN DEVELOPMENT AND LEARNING IN SCHOOL SETTINGS I, II, III. (2, 2, 2)

A sequence of courses which enables in-service teachers and administrators to carry on advanced study of human development and learning principles in the continuous study and evaluation of several different phases of the school program over an extended period of time. (Staff.)

H. D. ED. 145. GUIDANCE OF YOUNG CHILDREN. (3)

Development of an appreciation and understanding of young children from different home and community backgrounds; study of individual and group problems. (Hymes.)

For Graduates

H. D. ED. 200. INTRODUCTION TO HUMAN DEVELOPMENT AND CHILD STUDY. (3)

Offers a general overview of the scientific principles which describe human development and behavior and makes use of these principles in the study of

individual children. Each student will observe and record the behavior of an individual child throughout the semester and must have one half-day a week for this purpose. It is basic to further work in child study and serves as a prerequisite for advanced courses where the student has not had field work or at least six weeks of workshop experience in child study. When offered during the summer intensive laboratory work with case records may be substituted for the study of an individual child. (Kurtz, Kyle, Thompson.)

H. D. ED. 201. BIOLOGICAL BASES OF BEHAVIOR. (3)

H. D. Ed. 200 or its equivalent must be taken before H. D. 201 or concurrently. Emphasizes that understanding human life, growth and behavior depends on understanding the ways in which the body is able to capture, control and expend energy. Application throughout is made to human body processes and implications for understanding and working with people. (Chapin.)

H. D. ED. 202. SOCIAL BASES OF BEHAVIOR. (3)

H. D. Ed. 200 or its equivalent must be taken before H. D. Ed. 202 or concurrently. Analyzes the socially inherited and transmitted patterns of pressures, expectations and limitations learned by an individual as he grows up. These are considered in relation to the patterns of feeling and behaving which emerge as the result of growing up in one's social group. (Bowie, Klevan.)

H. D. ED. 203. INTEGRATIVE BASES OF BEHAVIOR. (3)

H. D. Ed. 200, or its equivalent, H. D. Ed. 201 and H. D. Ed. 202 are prerequisite. Analyzes the organized and integrated pattern of feeling, thinking and behaving which emerge from the interaction of basic biological drives and potentials with one's unique experience growing up in a social group. (Bowie.)

H. D. ED. 204, 205. PHYSICAL PROCESSES IN HUMAN DEVELOPMENT. (3, 3)

Prerequisite. 200 or equivalent. Describes in some detail the major organic processes of: conception, biological inheritance; differentiation and growth of the body; capture, transportation and use of energy; perception of the environment; coordination and integration of function; adaptation to unusual demands and to frustration; normal individual variation in each of the above processes.

(Chapin.)

H. D. ED. 206, 207. SOCIALIZATION PROCESSES IN HUMAN DEVELOPMENT I, II. (3, 3)

Prerequisite, 200 or equivalent. Analyzes the processes by which human beings internalize the culture of the society in which they live. The major sub-cultures in the United States, their training procedures, and their characteristic human expresssions in folk-knowledge, habits, attitudes, values, life-goals, and adjustment patterns are analyzed. Other cultures are examined to highlight the American way of life and to reveal its strengths and weaknesses.

(Kurtz, Mershon.)

H. D. ED. 208, 209. SELF PROCESSES IN HUMAN DEVELOPMENT I AND II. (3, 3)

Prerequisite. 200 or equivalent. Analyzes the effects of the various physical and growth processes, affectional relationships, socialization processes, and peer group roles and status on the integration, development, adjustment, and realization of the individual self. This analysis includes consideration of the nature of

intelligence and of the learning process; the development of skills, concepts, generalizations, symbolizations, reasoning and imagination, attitudes, values, goals and purposes; and the conditions, relationships and experiences that are essential to full human development. The more common adjustment problems experienced in our society at various maturity levels, and the adjustment mechanisms used to meet them are studied. (Goering, Mershon.)

H. D. ED. 210. AFFECTIONAL RELATIONSHIPS AND PROCESSES IN HUMAN DEVELOPMENT. (3)

H. D. Ed. 200 or its equivalent must be taken before or concurrently. Describes the normal development, expression and influence of love in infancy, childhood, adolescence and adulthood. It deals with the influence of parent-child relationship involving normal acceptance, neglect, rejection, inconsistency, and over-protection upon health, learning, emotional behavior and personality adjustment and development. (Hatfield.)

H. D. ED. 211. PEER-CULTURE AND GROUP PROCESSES IN HUMAN DEVELOPMENT. (3)

H. D. Ed. 200 or its equivalent must be taken before or concurrently. Analyzes the process of group formation, role-taking and status-winning. It describes the emergence of the "peer-culture" during childhood and the evolution of the child society at different maturity levels to adulthood. It analyzes the developmental tasks and adjustment problems associated with winning belonging and playing roles in the peer group. (Hatfield.)

H. D. ED. 212, 214, 216. ADVANCED SCIENTIFIC CONCEPTS IN HUMAN DEVELOPMENT I, II, III. (3, 3, 3)

Summer session. (Staff.)

H. D. ED. 213, 215, 217. ADVANCED LABORATORY IN BEHAVIOR ANALYSIS I, II, III. (3, 3, 3)

Summer session. (Staff.)

H. D. ED. 221. LEARNING THEORY AND THE EDUCATIVE PROCESS I. (3)

Provides a systematic review of the major theories of learning and their impact on education. Considers factors that influence learning. (Lawson, Milhollan, Perkins.)

H. D. ED. 222. LEARNING THEORY AND THE EDUCATIVE PROCESS II. (3)

Provides an exploration in depth of current theoretical and research developments in the field of human learning, especially as related to educational processes. Considers factors that influence learning. (Perkins.)

H. D. ED. 230, 231. FIELD PROGRAM IN CHILD STUDY I AND II. (2-6)

Prerequisite, consent of instructor. Offers apprenticeship training preparing properly qualified persons to become staff members in human development workshops, consultants to child study field programs and coordination of municipal or regional child study programs for teachers or parents. Extensive field experience is provided. In general this training is open only to persons who have passed their preliminary examinations for the doctorate with a major in human development or psychology. (Kurtz, Thompson.)

H. D. ED. 250a, 250b, 250c. DIRECT STUDY OF CHILDREN. (1, 1, 1)

May not be taken concurrently with H. D. Ed. 102, 103, or 104. Provides the opportunity to observe and record the behavior of an individual child in a nearby school. These records will be used in conjunction with the advanced courses in human development and this course will be taken concurrently with such courses. Teachers active in their jobs while taking advanced courses in human development may use records from their own classrooms for this course. A minimum of one year of direct observation of human behavior is required of all human development students at the master's level. This requirement may be satisfied by this course. (Staff.)

H. D. ED. 260. SYNTHESIS OF HUMAN DEVELOPMENT CONCEPTS. (3)

Prerequisites, H. D. Ed. 204, 206 and 208. A seminar wherein advanced students work toward a personal synthesis of their own concepts in human growth and development. Emphasis is placed on seeing the dynamic interrelations between all processes in the behavior and development of an individual. (Morgan.)

H. D. ED. 270. SEMINARS IN SPECIAL TOPICS IN HUMAN DEVELOPMENT. (2-6)

Prerequisite, consent of the instructor. An opportunity for advanced students to focus in depth on topics of special interest growing out of their basic courses in human development. (Staff.)

INDUSTRIAL EDUCATION

For Graduates and Advanced Undergraduates

IND. ED. 115. RESEARCH AND EXPERIMENTATION IN INDUSTRIAL ARTS (3)

This is a laboratory-seminar course designed to develop persons capable of planning, directing, and evaluating effective research and experimentation procedures with the materials, products, and processes of industry. (Maley.)

IND. ED. 121. INDUSTRIAL ARTS IN SPECIAL EDUCATION. (3)

Four hours laboratory per week, one hour lecture. Prerequisite, Sp. Ed. 170 and 171 or consent of instructor. Laboratory fee $5.00. This course provides experiences of a technical and theoretical nature in industrial processes applicable for classroom use. Emphasis is placed on individual research in the specific area of one's major interest in special education. (Staff.)

IND. ED. 125, 126. INDUSTRIAL TRAINING IN INDUSTRY I, II. (3, 3)

The first course is designed to provide an overview of the function of industrial training, type of programs, organization, development and evaluation. The second course (prerequisite the first course) is designed to study specific training programs in a variety of industries, plan program visitation, training program development, and analyses of industrial training research. (Merrill.)

IND. ED. 143. INDUSTRIAL SAFETY EDUCATION I. (2)

This course deals briefly with the history and developing of effective safety programs in modern industry and treats causes, effects, and values of industrial safety education inclusive of fire prevention and hazard controls. (Staff.)

IND. ED. 144. INDUSTRIAL SAFETY EDUCATION II. (2)

In this course exemplary safety practices are studied through conference discussions, group demonstrations, and organized plant visits to selected industrial situations. Methods of fire precautions and safety practices are emphasized. Evaluative criteria in safety programs are formulated. (Staff.)

IND. ED. 150. TRAINING AIDS DEVELOPMENT. (3)

Study of the aids in common use as to their source and application. Special emphasis is placed on principles to be observed in making aids useful to shop teachers. Actual construction and application of such devices will be required. (Maley.)

IND. ED. 157. TESTS AND MEASUREMENTS. (3)

Prerequisite, Ed. 150 or consent of instructor. The construction of objective tests for occupational and vocational subjects. (Luetkemeyer.)

IND. ED. 161. PRINCIPLES OF VOCATIONAL GUIDANCE. (2)

This course identifies and applies the underlying principles of guidance to the problems of educational and vocational adjustment of students. (Staff.)

IND. ED. 164. LABORATORY ORGANIZATION AND MANAGEMENT. (3)

This course covers the basic elements of organizing and managing an industrial education program including the selection of equipment and the arrangement of the shop. (Crosby, Schramm.)

IND. ED. 165. MODERN INDUSTRY. (3)

This course provides an overview of manufacturing industry in the American social, economic, and culture pattern. Representative basic industries are studied from the viewpoints of personnel and management organization, industrial relations, production procedures, distribution of products, and the like. (Harrison.)

IND. ED. 166. EDUCATIONAL FOUNDATIONS OF INDUSTRIAL ARTS. (2)

A study of the factors which place industrial arts education in any well-rounded program of general education. (Luetkemeyer.)

IND. ED. 167. PROBLEMS IN OCCUPATIONAL EDUCATION. (3)

The purpose of this course is to secure, assemble, organize, and interpret data relative to the scope, character and effectiveness of occupational education. (Staff.)

IND. ED. 169. OCCUPATIONAL ANALYSIS AND COURSE CONSTRUCTION. (3)

Provides a working knowledge of occupational and job analysis and applies the techniques in building and reorganizing courses of study for effective use in vocational and occupational schools. (Staff.)

IND. ED. 171. HISTORY AND PRINCIPLES OF VOCATIONAL EDUCATION. (3)

An overview of the development of vocational education from primitive times to the present with special emphasis given to the vocational education movement within the American program of public education. (Staff.)

Ind. Ed. 175. Recent Technological Developments in Products and Processes. (3)

This course is designed to give the student an understanding of recent technological developments as they pertain to the products and processes of industry. The nature of the newer products and processes is studied as well as their effect upon modern industry and/or society. (Crosby.)

For Graduates

Ind. Ed. 207. Philosophy of Industrial Arts Education. (3)

This course is intended to assist the student in his development of a point of view in regard to industrial arts and its relationship with the total educational program. He should, thereby, have a "yardstick" for appraising current procedures and proposals and an articulateness for his own professional area. (Harrison.)

Ind. Ed. 214. School Shop Planning and Equipment Selection. (3)

This course deals with principles involved in planning a school shop and provides opportunities for applying these principles. Facilities required in the operation of a satisfactory shop program are catalogued and appraised. (Tierney.)

Ind. Ed. 216. Supervision of Industrial Arts. (2)

(Tierney.)

Ind. Ed. 220. Organization, Administration, and Supervision of Vocational Education. (2)

This course surveys objectively the organization, administration, supervision, curricular spread and viewpoint, and the present status of vocational education. (Staff.)

Ind. Ed. 240. Research in Industrial Arts and Vocational Education. (2)

This is a course offered by arrangement for persons who are conducting research in the areas of industrial arts and vocational education. (Staff.)

Ind. Ed. 241. Content and Method of Industrial Arts. (3)

Various methods and procedures used in curriculum development are examined and those suited to the field of industrial arts education are applied. Methods of and devices for industrial arts instruction are studied and practiced. (Maley.)

Ind. Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(Staff.)

Ind. Ed. 250. Teacher Education in Industrial Arts. (3)

This course is intended for the Industrial Arts teacher educator at the college level. It deals with the function and historical development of Industrial Arts Teacher education. Other areas of content include administration program and program development, physical facilities and requirements, staff organization and relationships, college-secondary school relationships, philosophy and evaluation. (Harrison.)

SECONDARY EDUCATION

GENERAL AND ACADEMIC

For Graduates and Advanced Undergraduates

SEC. ED. 130. THE JUNIOR HIGH SCHOOL. (2-3)

A general overview of the junior high school. Purposes, functions and characteristics of this school unit; a study of its population, organization, program of studies, methods, staff, and other similar topics, together with their implications for prospective teachers. (McClure, Grambs.)

SEC. ED. 134. MATERIALS AND PROCEDURES FOR THE SECONDARY SCHOOL CORE CURRICULUM. (3)

Laboratory fee, $1.00. This course is designed to bring practical suggestions to teachers who are in charge of core classes in junior and senior high schools. Materials and teaching procedures for specific units of work are stressed. (Grambs.)

SEC. ED. 139. SPEECH METHODS AND RESOURCES IN SECONDARY SCHOOLS. (3)

Practical suggestions for developing curricular and extra-curricular speech programs. Planning units and courses of study, current trends, and aims of speech education, use of printed and audio-visual materials, evaluating of performance, directed speech activities, and the teaching of listening. (Frank.)

For Graduates

SEC. ED. 239. SEMINAR IN SECONDARY EDUCATION. (2)

(Adkins, McClure, Risinger.)

SEC. ED. 240. TRENDS IN SECONDARY SCHOOL CURRICULUM. (3)

A. English B. Foreign Language C. Mathematics D. Science E. Social Studies F. Speech G. General H. Home Economics Education. Recent developments in educational thinking and practice which have affected the curriculum in one of the specified academic areas. (Staff.)

SEC. ED. 247. SEMINAR IN SCIENCE EDUCATION. (2)

An opportunity to pursue special problems in curriculum making, course of study development, or other science teaching problems. Class members may work on problems related directly to their own school situations. (Lockard.)

SEC. ED. 268. SEMINAR IN EDUCATIONAL SOCIOLOGY. (2)

(Grambs.)

BUSINESS EDUCATION

For Graduates and Advanced Undergraduates

B. ED. 101. PROBLEMS IN TEACHING OFFICE SKILLS. (3)

Problems in development of occupational competency, achievement tests, standards of achievement, instructional materials, transcription, and the integration of office skills. For experienced teachers. (Patrick.)

B. ED. 102. METHODS AND MATERIALS IN TEACHING BOOKKEEPING AND RELATED SUBJECTS. (3)

Important problems and procedures in the mastery of bookkeeping and related office knowledges and skills including a consideration of materials and teaching procedures. (Patrick.)

B. ED. 104. BASIC BUSINESS EDUCATION IN THE SECONDARY SCHOOLS. (3)

Includes consideration of course objectives; subject matter selection: and methods of organizing and presenting business principles, knowledges, and practices. (Patrick.)

For Graduates

B. ED. 200. ADMINISTRATION AND SUPERVISION OF BUSINESS EDUCATION. (3)

Major emphasis on departmental organization and its role in the school program, curriculum, equipment, budget-making, supervision, guidance, placement and follow-up, school-community relationships, qualifications and selection of teaching staff, visual aids and in-service programs for teacher development. For administrators, supervisors, and teachers. (Patrick.)

B. ED. 205. SEMINAR IN BUSINESS EDUCATION. (2)

The study and evaluation of the literature and research in Business Education.

B. ED. 255. PRINCIPLES AND PROBLEMS OF BUSINESS EDUCATION. (2-3)

Principles, objectives, and practices in business education; occupational foundations; current attitudes of business, labor and school leaders; general business education relation to consumer business education and to education in general. (Patrick.)

B. ED. 256. CURRICULUM DEVELOPMENT IN BUSINESS EDUCATION. (2-3)

This course is especially designed for graduate students interested in devoting the summer session to a concentrated study of curriculum planning in business education. Emphasis will be placed on the philosophy and objectives of the business education program, and on curriculum research and organization of appropriate course content. (Staff.)

HOME ECONOMICS EDUCATION

For Graduates and Advanced Undergraduates

H. E. ED. 102. PROBLEMS IN TEACHING HOME ECONOMICS. (3)

Prerequisites, H. E. Ed. 140. A study of the managerial aspects of teaching and administering a homemaking program, the physical environment, organization, and sequence of instructional units, resource materials, evaluation, home projects. (Spencer.)

H. E. ED. 120. EVALUATION OF HOME ECONOMICS. (3)

The meaning and function of evaluation in education; the development of a plan for evaluating a homemaking program with emphasis upon types of evaluation devices, their construction, and use. (Spencer.)

For Graduates

H. E. ED. 200. SEMINAR IN HOME ECONOMICS EDUCATION. (2)
(Spencer.)

H. E. ED. 202. TRENDS IN THE TEACHING AND SUPERVISION OF HOME ECONOMICS. (2-4)

Study of home economics programs and practices in light of current educational trends. Interpretation and analysis of democratic teaching procedures, outcomes of instruction, and supervisory practices. (Spencer.)

MUSIC EDUCATION

For Graduates and Advanced Undergraduates

MUS. ED. 125. CREATIVE ACTIVITIES IN THE ELEMENTARY SCHOOL. (2)
Prerequisite, Music 16 or consent of instructor. A study of the creative approach to singing, listening, playing, rhythmic activity, and composition. These topics are studied in correlation with other areas and creative programs.
(Staff.)

MUS. ED. 128. MUSIC FOR ELEMENTARY CLASSROOM TEACHER. (2-3)
Prerequisite, Music 16 or consent of instructor. A study of the group activities and materials through which the child experiences music. The course is designed to aid both music specialists and classroom teachers. It includes an outline of objectives and a survey of instructional methods. (Eisenstadt.)

MUS. ED. 132. MUSIC IN THE SECONDARY SCHOOL. (2-3)
Prerequisite, consent of instructor. A study of the vocal and instrumental programs in the secondary schools. A survey of the needs in general music and the relationship of music to the core curriculum. (Eisenstadt.)

MUS. ED. 139. MUSIC FOR THE ELEMENTARY SCHOOL SPECIALIST. (2)
Prerequisite, senior standing. A survey of instructional materials; objectives; organization of subject matter; lesson planning; methods and procedures in singing, listening, rhythms, simple instruments and creative activities for the music specialist in the elementary school. Twenty periods of observation will be required for three credits. (Eisenstadt.)

MUS. ED. 163. BAND TECHNIQUES AND ADMINISTRATION. (2)
Prerequisites, Music 81 and 161. Two lectures and two laboratory hours per week. Intensive study of a secondary wind instrument and of rehearsal techniques. A survey of instructional materials, administrative procedures, and band pageantry will be included. (Dunham.)

MUS. ED. 170. METHODS AND MATERIALS FOR CLASS PIANO INSTRUCTION. (2)
The study of the principles and techniques of teaching class piano. The following groups, beginning and advanced, will be used for demonstrations: elementary school children, junior and senior high school students, adults. Special emphasis will be placed on the analysis of materials. (de Vermond.)

MUS. ED. 171. STRING TEACHING IN THE PUBLIC SCHOOLS. (2)

A study of the problems of organizing and developing the string program in the public schools. Emphasis is placed on exploratory work in string instruments, on the study of teaching techniques, and on the analysis of music literature for solo, small ensembles, and orchestra. (Berman.)

MUS. ED. 173. THE VOCAL MUSIC TEACHER AND SCHOOL ORGANIZATION. (2)

Prerequisite, practice teaching or teaching experience. Study of the function of the vocal music teacher in the elementary and secondary schools. Students will serve as resource teachers for those enrolled in Mus. Ed. 139. Open to graduate students by permission of instructor. (Fanos.)

MUS. ED. 175. METHODS AND MATERIALS IN VOCAL MUSIC FOR THE HIGH SCHOOL. (2-4)

Prerequisite, consent of instructor. A survey of suitable vocal and choral repertoire for the high school. Problems of diction interpretation, tone production, and phrasing. The course is designed primarily for choral directors and teachers of voice classes. (Grentzer.)

MUS. ED. 180. INSTRUMENTAL MUSIC FOR THE HIGH SCHOOL. (2)

Prerequisite, consent of instructor. A survey of the repertoires for high school orchestra, band, and small ensemble. Problems of interpretations, intonation, tone quality, and rehearsal techniques. The course may be repeated for credit, since different repertoires are covered each time the course is offered. (Dunham.)

For Graduates

MUS. ED. 200. RESEARCH METHODS IN MUSIC AND MUSIC EDUCATION. (3)

The application of methods of research to problems in the fields of music and music education. The preparation of bibliographies and the written exposition of research projects in the area of the student's major interest. (Grentzer.)

MUS. ED. 201. ADMINISTRATION AND SUPERVISION OF MUSIC IN THE PUBLIC SCHOOLS. (3)

The study of basic principles and practices of supervision and administration with emphasis on curriculum construction, scheduling, budgets, directing of in-service teaching, personnel problems, and school-community relationships. (Grentzer.)

MUS. ED. 204. CURRENT TRENDS IN MUSIC EDUCATION. (SEMINAR). (3)

A survey of current philosophies and objectives of music in the schools. The scope and sequence of the music curricula, vocal and instrumental, on the elementary and secondary levels. (Grentzer.)

MUS. ED. 205. VOCAL MUSIC IN THE ELEMENTARY SCHOOLS. (3)

A comparative analysis of current methods and materials used in the elementary schools. A study of the music curriculum as a part of the total school program, and of the roles of the classroom teacher and the music specialist. (Grentzer.)

MUS. ED. 206. CHORAL CONDUCTING AND REPERTOIRE. (3)

The study and reading of choral literature of all periods, including the contemporary, suitable for use in school and community choruses. Style, interpretation, tone quality, diction, rehearsal and conducting techniques are analyzed. (Staff.)

MUS. ED. 207. VOCAL MUSIC IN THE SECONDARY SCHOOLS. (3)

A comparative analysis of current methods and materials used in teaching junior and senior high-school classes in general music, history and appreciation, theory, and voice; and in directing choral groups and community singing. (Grentzer.)

MUS. ED. 208. THE TEACHING OF MUSIC APPRECIATION. (3)

A study of the objectives for the elementary and secondary levels; the techniques of directed listening, the presentation of theoretical and biographical materials, course planning, selection and use of audio-visual aids, and library materials, and the correlation between music and other arts. (Dunham.)

MUS. ED. 209. SEMINAR IN INSTRUMENTAL MUSIC. (2)

A consideration of acoustical properties and basic techniques of the instruments. Problems of ensemble and balance, intonation, precision, and interpretation are studied. Materials and musical literature for orchestras, bands and small ensembles are evaluated. (Dunham.)

MUS. ED. 210. ADVANCED ORCHESTRATION AND BAND ARRANGING. (SEMINAR). (2)

Prerequisite, Music 147 or the equivalent, or consent of the instructor. A study of arranging and transcription procedures in scoring for the orchestra and band. Special attention is given to the arranging problems of the instrumental director in the public schools. (Dunham.)

MUS. ED. 250. HISTORY AND AESTHETICS OF MUSIC EDUCATION. (3)

Prerequisite, permission of instructor. The study of the development of pedagogical practice in music education, their aesthetic implications and educational values. (Grentzer.)

SPECIAL EDUCATION

SP. ED. 170. INTRODUCTION TO SPECIAL EDUCATION. (3)

Designed to give an understanding of the needs of all types of exceptional children, stressing preventive and remedial measures.

(Campbell, Renz, Simms.)

SP. ED. 171. CHARACTERISTICS OF EXCEPTIONAL CHILDREN. (3-6)

A. Mentally Retarded. B. Gifted. C. Perceptually impaired. Prerequisite, Sp. Ed. 170. Studies the diagnosis, etiology, physical, social, and emotional characteristics of exceptional children. (Renz, Simms.)

SP. ED. 172. EDUCATION OF EXCEPTIONAL CHILDREN. (3-6).

A. Mentally Retarded. B. Gifted. C. Perceptually impaired. Prerequisite, Sp. Ed. 171 or equivalent. Offers practical and specific methods of teaching exceptional children. Selected observation of actual teaching may be arranged.

(Campbell, Simms.)

SP. ED. 173. CURRICULUM FOR EXCEPTIONAL CHILDREN. (3-6)

A. Mentally Retarded. B. Gifted. Prerequisite, Sp. Ed. 171 or equivalent. Examines the principles and objectives guiding curriculum for exceptional children; gives experience in developing curriculum for these children; studies various curricula currently in use. (Campbell, Hebeler.)

SP. ED. 175. EDUCATION OF THE SLOW LEARNER. (3)

Course content includes the characteristics of the slow learner and those educational practices which are appropriate for the child who is functioning as a slow learner. (Hebeler.)

For Graduates

SP. ED. 200. EXCEPTIONAL CHILDREN AND YOUTH. (3)

Prerequisite, consent of instructor. Deals primarily with research relevant to the intellectual, psychological, physical, and emotional characteristics of exceptional children. (Renz.)

SP. ED. 201. EMOTIONALLY HANDICAPPED CHILDREN AND YOUTH. (3)

Prerequisite, Special Education 200 and consent of instructor. Deals with epidemeology, etiology, classification, diagnostic procedures, behavioral characteristics, treatment and prevention of child and adolescent disturbances. (Huber.)

SP. ED. 205. THE EXCEPTIONAL CHILD AND SOCIETY. (3)

Prerequisite, Sp. Ed. 200 or consent of instructor. Relationship of the role and adjustment of the child with an exceptionality to societal characteristics. (Renz.)

SP. ED. 210. ADMINISTRATION AND SUPERVISION OF SPECIAL EDUCATION PROGRAMS. (3)

Prerequisite, consent of instructor. Consideration of the determination, establishment and function of educational programs for exceptional children for administrative and supervisory personnel. (Hebeler.)

SP. ED. 215. EVALUATION AND MEASUREMENT OF EXCEPTIONAL CHILDREN AND YOUTH. (3)

Prerequisites, Ed. 150, Ed. 151, Sp. Ed. 200. Deals with the understanding and interpretation of the results of psychological and educational tests applicable for use with exceptional children. (Campbell, Simms.)

SP. ED. 220. EDUCATIONAL DIAGNOSIS AND PLANNING FOR EXCEPTIONAL CHILDREN AND YOUTH. (3)

Prerequisite, Sp. Ed. 215. Deals with the identification of learning characteristics of exceptional children and the planning of appropriate programs. (Campbell, Hebeler.)

SP. ED. 221. PSYCHO-EDUCATIONAL PROGRAMMING WITH EMOTIONALLY HANDICAPPED CHILDREN AND YOUTH. (3)

Prerequisite, Special Education 200. Special Education 201 and consent of instructor. Deals with factors pertinent to therapeutic education of disturbed children and adolescents in special treatment settings. (Huber.)

Sp. Ed. 225. Problems in the Education of the Mentally Retarded. (3)

Prerequisite, 9 hours Sp. Ed. including Sp. Ed. 200. or consent of instructor. Consideration of the pertinent psychological, educational. medical, sociological and other relevant research and theoretical material relevant to the determination of trends, practices, regarding the mentally retarded. (Renz.)

Sp. Ed. 230. Problems in the Education of the Gifted. (3)

Prerequisite, 9 hours Sp. Ed. including Sp. Ed. 200, or consent of instructor. Consideration of the pertinent psychological, educational, medical, sociological and other relevant research and theoretical material relevant to the determination of trends, practices, regarding the gifted. (Hebeler.)

Sp. Ed. 235. Problems in the Education of Children with Emotional Disturbances. (3)

Prerequisite, 9 hours Sp. Ed. including Sp. Ed. 200, or consent of instructor. Consideration of the pertinent psychological, educational, medical, sociological and other relevant research and theoretical material relevant to the determination of trends, practices, regarding the emotionally disturbed. (Huber.)

Sp. Ed. 240. Problems in the Education of Children with Perceptual Impairment. (3)

Prerequisite, 6 hours in Education of the Perceptually Impaired, Special Education 215, and Special Education 220 or consent of instructor. Consideration of the pertinent psychological. educational, medical, sociological and other relevant research and theoretical material relevant to the determination of trends, practices, regarding the perceptually impaired. (Campbell, Hebeler.)

Sp. Ed. 278. Seminar in Special Education. (2)

Prerequisite, 9 hours in Special Education, or consent of instructor. An overview of education of exceptional children. (Hebeler.)

ENGLISH LANGUAGE AND LITERATURE

Professors: Murphy, Aldridge, Bode, Cooley, Harman (emeritus), McManaway (p.t.), Manning, Mish, and Zeeveld.

Associate Professors: Barnes, Beall, Brown, Fleming, Gravely, Hovey, Lutwack, Myers, Portz, G. Smith, Thorberg, Ward, and Weber.

Assistant Professors: Birdsall, Brosnahan, Bryer, Cooper, Duffy, Herman, S. Holton, Houppert, Jellema, Kinnaird, Kenney, Lawson, Logan, McMillan, Panichas, Rodgers, D. Smith, and Wilson.

Visiting Lecturer: Fletcher.

The Department of English offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Candidates normally take

both major and minor work within the Department of English, but with permission students may take minor work in other departments.

Departmental requirements for the degree of Master of Arts include: (1) Eng. 201; (2) 3 credits from the following: Eng. 101, 102, 105, 107; (3) 6 credits in the English 230 series. Candidates must meet a foreign language requirement by either (1) passing the Graduate School reading examination in French or German; or (2) submitting a record of 12 undergraduate credits in one of the following languages: French, German, Spanish, Italian, Latin, or Greek. Students who wish to continue their work in this department towards the doctorate will be expected to elect the first alternative.

Departmental requirements for the degree of Doctor of Philosophy include: (1) a reading knowledge of French and German; (2) Eng. 102 and 202; (3) an oral qualifying examination (normally waived for University of Maryland Masters of Arts in English), to be taken in the first year of residence after the master's degree or its equivalent; (4) a comprehensive written examination on English and American literature.

For Graduates and Advanced Undergraduates

Eng. 101. History of the English Language. (3)
(Herman, James.)

Eng. 102. Old English. (3)
(Brosnahan, S. Holton.)

Eng. 104. Chaucer. (3)
(Cooley, Brosnahan, McMillan.)

Eng. 105. Introduction to Linguistics. (3)
(Same as Foreign Language 101.) (Miller.)

Eng. 107. American English. (3)
(Staff.)

Eng. 110, 111. Elizabethan and Jacobean Drama. (3, 3)
(Zeeveld.)

Eng. 112, 113. Literature of the Renaissance. (3, 3)
(Zeeveld, Mish, Cooper.)

Eng. 115, 116. Shakespeare. (3, 3)
(Zeeveld, Cooper, Houppert, Logan, D. Smith.)

Eng. 120. English Drama from 1660 to 1880. (3)
(Ward.)

Eng. 121. Milton. (3)
(Murphy, Mish, Weber.)

Eng. 122. Literature of the Seventeenth Century, 1600-1660. (3)
(Mish, Murphy.)

Eng. 123. Literature of the Seventeenth Century, 1660-1700. (3)
(Wilson.)

Eng. 125, 126. Literature of the Eighteenth Century. (3, 3)
(Myers.)

Eng. 129, 130. Literature of the Romantic Period. (3, 3)
(Weber, Kinnaird, G. Smith.)

Eng. 134, 135. Literature of the Victorian Period. (3, 3)
(Brown, Fletcher.)

Eng. 139, 140. The English Novel. (3, 3)
(Ward, Kenney.)

Eng. 141. Major British Writers. (3)
Two writers studied intensively each semester.
(Fleming, Panichas, Fletcher.)

Eng. 143. Modern Poetry. (3)
(Fleming, Jellema.)

Eng. 144. Modern Drama. (3)
(Weber, Bryer.)

Eng. 145. The Modern Novel. (3)
(Panichas, Lawson.)

Eng. 148. The Literature of American Democracy. (3)
(Barnes.)

Eng. 150, 151. American Literature. (3, 3)
(Gravely, Hovey, Thorberg, Bryer, Lawson.)

Eng. 152. The Novel in America. (3)
(Hovey, Thorberg.)

Eng. 155, 156. Major American Writers. (3, 3)
(Gravely, Lutwack, Portz, Manning.)

Eng. 157. Introduction to Folklore. (3)
(Birdsall, McMillan.)

Eng. 160. Advanced Expository Writing. (3)
(Myers, Herman, Rodgers.)

Eng. 170. Creative Writing. (3)
(Fleming, Jellema.)

Eng. 171. Advanced Creative Writing. (3)
Prerequisite, permission of the instructor. (Fleming.)

Eng. 172. Playwriting. (3)
Prerequisite, permission of the instructor. (Fleming.)

Eng. 190, 191. Honors Conference and Reading. (1, 1)
(Staff.)

Eng. 199. Senior Proseminar in Literature. (3)
(Portz.)

For Graduates

Eng. 201. Bibliography and Methods. (3)
(Mish, Hovey, Bryer, Cooper, D. Smith.)

Eng. 202. Middle English. (3)
(Brosnahan, S. Holton.)

Eng. 204. Seminar in Medieval Literature. (3)
(Cooley, Brosnahan.)

Eng. 206, 207. Seminar in Renaissance Literature. (3,3)
(Zeeveld, McManaway, Mish.)

Eng. 210. Seminar in Seventeenth Century Literature. (3)
(Mish.)

Eng. 212, 213. Seminar in Eighteenth Century Literature. (3, 3)
(Myers.)

Eng. 214, 215. Seminar Nineteenth Century Literature. (3, 3)
(Brown, Kinnaird, Fletcher.)

Eng. 216, 217. Literary Criticism. (3, 3)
(Lutwack.)

Eng. 218. Seminar in Literature and the Other Arts. (3)
(Myers.)

Eng. 225,226. Seminar in American Literature. (3, 3)
(Bode, Hovey.)

Eng. 227, 228. Problems in American Literature. (3, 3)
(Aldridge.)

Eng. 230. Special Studies in English Literature to 1600. (3)
(Cooley, Cooper.)

Eng. 232. Special Studies in English Literature, 1600-1800. (3)
(Mish, Myers.)

Eng. 235. Special Studies in Nineteenth Century English Literature. (3)
(Brown, G. Smith.)

Eng. 237. Special Studies in American Literature. (3)
(Lutwack, Portz.)

Eng. 241, 242. Studies in Twentieth Century Literature. (3, 3)
(Bode, Hovey, Panichas, Lawson.)

Eng. 399. Thesis Research. (1-6)
(Staff.)

ELECTRICAL ENGINEERING

Professors: Tompkins, Chu, Reed, and Wagner.

Associate Professors: Basham, Ferris, Hochuli, Price, Reiser, Rutelli, and Simons.

Assistant Professors: Ginnings, Marcovitz, and Pugsley.

Lecturers: Bullis, Degenford, H. C. Jones, Schulman, and Whicker.

Instructors Firouzabadi, Friedman, Glock, Guha, Hahn, Larson, R. D. Martin, R. L. Martin, Miller, Moldavsky, Pottala, and Rumbaugh.

Courses in electrical engineering are presently offered in three general areas. The areas, and topics in which opportunities for specialization and research are particularly favorable, are as follows:

1. ELECTROMAGNETICS AND PHYSICAL ELECTRONICS
   a. Radio Wave Propagation and Antennas
   b. Quantum Electronics; Lasers
   c. Electron and Ion Beams; Cyclotron Design
   d. Semiconductor Device Properties and Characterization (Also part of Area 2)
   e. Electrical Engineering in Medicine and Biology (Also part of Area 2)

2. CIRCUITS AND CONTROL SYSTEMS
   a. Electronic Circuits and Systems
   b. Network Theory
   c. Continuous and Sampled Data Control Systems

3. INFORMATION SCIENCES
   a. Computer Systems Design and Analysis
   b. Switching Theory
   c. Communication and Information Theory
   d. Mechanized Storage and Retrieval of Scientific Information

Departmental requirements for advanced degrees, in addition to the requirements of the Graduate School, are as follows:

Electrical Engineering

Master of Science

The major program must be selected from two areas of electrical engineering. The minor program must be composed of either

1. An 8-12 semester credit program outside the Electrical Engineering Department, or
2. at least 6 credits outside the Department and at least 6 credits in an area of electrical engineering not included in the major program.

A closed book Master's Qualifying Examination is required. It is designed to insure that the student has a broad basic knowledge of electrical engineering and applied mathematical principles. The student should take it as early in his program as practicable, but before he begins his last 12 credits of course work or his thesis research.

At least 6 semester credits of thesis registration and an acceptable thesis are required. Once started, thesis registration must continue consecutively each fall and spring until the thesis is completed. The thesis should present an independent accomplishment in a research, development, or applications area of engineering. It may, under certain circumstances, be supervised off campus, but it cannot be a (security) classified document. A comprehensive oral final examination is required.

Doctor of Philosophy

The major and minor programs must be arranged with the Department on an individual basis, and considerable flexibility is possible. While the major program must not be limited to one area of electrical engineering, it must contain a recognizable primary area in prepartion of research. If a single minor area is selected, it must consist of a coherent set of courses taken outside the Department. If two minor areas are selected, the first must be outside the Department; the second may consist of 9-12 credits in an area of electrical engineering not included in the major program.

A two-part written Doctoral Qualifying Examination is required. The first part covers the areas of mathematics, physics, and engineering that support electrical engineering. The second part deals specifically with electrical engineering through the first year of graduate study. A substantial choice of problems is provided, to accommodate varying backgrounds. The examination should be taken during the first 12 semester credits of course work after the Master's degree requirements have been completed.

The student will subsequently prepare a state-of-the-art paper in the area in which he intends to do his thesis. This should be done during the first one or two semesters of research registration, and will prepare the student for the Research Area Oral Examination, which follows. This examination consists first of presentation of the state-of-the-art paper, then questions on it and basic areas that directly support the proposed research. The goal of this examination is to establish the student's potential ability to perform the independent research he is proposing to carry out, and completes the

departmental requirements for Admission to Candidacy for the degree. The written Qualifying Examination must be repeated if the Research Area Oral is not completed within five years.

The doctoral thesis must present a significant contribution to the state-of-the-art and normally requires at least one year of full time work. The Doctoral Final Examination is prescribed by the Graduate School and is described elsewhere in this catalog.

ELECTROMAGNETICS AND PHYSICAL ELECTRONICS

For Graduates and Advanced Undergraduates

ENEE. 130,* 132.* Engineering Electromagnetics I, II. (3, 3)

Three hours of lecture per week. Prerequisites. Math. 22, Physics 21. and ENEE 90, with an average grade in Math. 21-22, Physics 20-21 and ENEE 90 of C or better. Required of juniors in electrical engineering. Electric and magnetic fields, using vector notation; Maxwell's equations; Lorentz force law; capacitance, inductance. and resistance; motion of charged particles; fields in material media, polarization, magnetization: boundary value problems. The study of electromagnetism is continued in ENEE 134. (Ginnings.)

ENEE. 134.* Engineering Electromagnetics III. (3)

Three hours of lecture per week. Prerequisite. ENEE 132. Required of seniors in electrical engineering. Continuation of ENEE 132. The wave equation and the impedance concept; plane waves; reflection and refraction; wave guides and transmission lines; Smith charts, lumped models. (Hochuli.)

ENEE. 135.* Electromagnetic Measurements Laboratory. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 134. Laboratory to be taken in association with ENEE 134. Experiments on field mapping, transmission line matching, impedance measurement; microwave measurements of standing wave ratio, power, frequency, Q, and coupling. (Ferris.)

ENEE. 140.* Transducers and Electrical Machinery. (3)

Three hours of lecture per week. (See ENEE 141 for related laboratory course.) Prerequisites, ENEE 120, ENEE 132. Corequisite, ENEE 141. Required of seniors in electrical engineering. Electromechanical transducers; theory of electromechanical systems; power and wide-band transformers; rotating electrical machinery from the theoretical and performance points of view. (Guha.)

ENEE. 141.* Transducers and Electrical Machinery Laboratory. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 140. Required of seniors in electrical engineering. Laboratory to be taken in association with ENEE 140. Experiments on transformers; synchronous machines; induction motors; synchros; loudspeakers; other transducers. (Guha.)

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* Graduate Credit not given to E. E. Majors for these courses.

ENEE. 170. Antennas and Wave Propagation (3)

Three hours of lecture per week. Corequisite. ENEE 134. Review of Maxwell's equations; radiation; antennas; radio wave propagation. (Reed.)

ENEE. 182. Introduction to Semiconductor Physical Electronics. (3)

Three hours of lecture per week. Prerequisites, ENEE 132 and Physics 153, or equivalent. Basic properties of semiconductors; idealized p-n junction and transistor theory; d-c parameters; low-frequency characteristics; frequency response; high-frequency characteristics; transistors as amplifiers and as switches; field effect transistors; integrated circuit considerations; other junction devices. (Tompkins.)

ENEE. 184. Physical Electronics of Vacuum and Gaseous Devices. (3)

Three hours of lecture per week. Prerequisites, ENEE 132 and Physics 153, or equivalents. Essential principles of quantum mechanics and quantum statistics; electron emission; electrons in electric and magnetic fields; space charge effects; vacuum tubes; electron beams; gas discharges and plasmas in electronic devices. (Reiser.)

ENEE. 186. Particle Accelerators, Physical and Engineering Principles. (3)

Three hours of lecture per week. Prerequisites, ENEE 132 and Physics 153, or consent of the instructor. Sources of charged particles; methods of acceleration and focusing of ion beams in electromagnetic fields; basic theory, design, and engineering principles of particle accelerators. (Reiser.)

For Graduates

ENEE. 201. Electromagnetic Theory. (3)

Two lectures per week. Prerequisite, ENEE 134 or 170 or 215, or equivalent. Theoretical analysis and engineering applications of Laplace's, Poisson's, and Maxwell's equations. (Hochuli.)

ENEE. 206, 207. Microwave Engineering (3, 3)

Two lectures, or one lecture and one laboratory, per week. Prerequisite, ENEE 201 or ENEE 216. Laboratory fee, ENEE 207, $5.00. Basic considerations in solving field problems using differential equations; circuit concepts and their validity at high frequency; guided electromagnetic waves; principles of masers and lasers; propagation and diffraction, including the optical region. Fundamental experiments at microwave and optical frequencies. (Hochuli.)

ENEE. 215, 216. Radio Wave Propagation. (3, 3)

Two lectures per week. Prerequisite, undergraduate degree in electrical engineering. physics, or mathematics. Maxwell's wave equation; concept of retarded magnetic vector potential; propagation over plane earth; propagation over spherical earth; refraction: meteorological effects; complex antennas; air-to-air propagation; lobe modulation. (Reed.)

ENEE. 245. Electrical Techniques in Medicine and Biology. (3)

Two lectures per week. Prerequisite, mathematics through differential equations and physics through electricity and magnetism, or equivalent. Electrical

properties of biological tissues and cell suspensions; alternating-current impedance spectroscopy; transducers and related instrumentation systems for biological measurements; biological control systems; interaction of electromagnetic fields with biological systems. (Ferris.)

ENEE. 250. MATHEMATICS FOR ELECTROMAGNETISM. (3)

Two lectures per week. Prerequisite, undergraduate preparation in electromagnetic theory and advanced calculus. Tensors and curvilinear coordinates; partial differential equations of electrostatics and electrodynamics; functionals, integral equations, and calculus of variations as applied to electromagnetism. (Rutelli.)

ENEE. 251. ANTENNA THEORY. (3)

Two lectures per week. Prerequisite, ENEE 250 or equivalent. Review of Maxwell's equations; radiative networks; linear antennas;; antenna arrays; aperture antennas; slot antennas; advanced topics. (Rutelli.)

ENEE. 280. ELECTRONIC PROPERTIES OF SEMICONDUCTORS. (3)

Three hours per week. Prerequisites, ENEE 182, or Math. 66 and Phys. 53, or equivalents. Properties of crystals; elementary topics from quantum mechanics; energy bands; electron transport theory; conductivity and Hall effect; statistical distributions; Fermi Level; impurities; non-equilibrium carrier distributions; normal modes of vibration; effects of high electric fields; p-n junction theory, avalanche breakdown; tunneling phenomena; surface properties. (Bullis.)

ENEE. 282. TECHNOLOGY OF SEMICONDUCTOR DEVICES AND MATERIALS. (3)

Three hours per week. Prerequisites, ENEE 182 or Phys. 53 or ENEE 290. Basic processes involved in the fabrication of transistors and other semiconductor devices; crystal growth and epitaxy; crystal orientation; purification and doping of crystals; diffusion; electrical and optical properties; photo-resist techniques; oxide passivation; contacts; device assembly and packaging. Emphasis is on silicon but other materials of engineering significance are considered. (Bullis.)

ENEE. 290. CHARGED PARTICLE DYNAMICS, ELECTRON AND ION BEAMS. (3)

Three hours per week. Prerequisite, consent of the instructor. General principles of single-particle dynamics; mapping of electric and magnetic fields; equation of motion and methods of solution; production and control of charged particle beams; electron optics; Liouville's theorem; space charge effects in high current beams; design principles of special electron and ion beam devices. (Reiser.)

CIRCUITS AND CONTROL SYSTEMS

For Graduates and Advanced Undergraduates

ENEE. 120.* CIRCUIT ANALYSIS II. (4)

Four hours of lecture per week. (See ENEE 121 for related laboratory course.) Prerequisite, ENEE 90. Corequisites, ENEE 121, Math. 66. Required

* Graduate Credit not given to E. E. Majors for these courses.

of juniors in electrical engineering. Continuation of ENEE 90. Complex frequency and frequency response: application of both frequency domain and time domain concepts: mutual inductance and transformers: polyphase concept; Fourier and Laplace transform methods: driving point and transfer functions; controlled sources. (Basham.)

ENEE. 121.* Circuit Laboratory II. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 120. Required of juniors in electrical engineering. Laboratory to be taken in association with ENEE 120. Steady-state and transient circuit measurements; frequency response. (Pugsley.)

ENEE. 122.* Electronic Circuits I. (4)

Four hours of lecture per week. (See ENEE 123 for related laboratory course.) Prerequisite, ENEE 120. Corequisites, ENEE 123, and ENEE 130. Required of juniors in electrical engineering. Transistors and electron tubes in dc, pulse, and small-signal situations; analysis of basic amplifiers; biasing; basic electronic switches; tuned and wideband amplifiers, feedback. ENEE 124 continues where ENEE 122 ends. (Simons.)

ENEE. 123.* Electronics Laboratory I. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 122. Required of juniors in electrical engineering. Laboratory to be taken in association with ENEE 122. Transistor and vacuum-tube characteristics; basic electronic switches; amplifiers; design practice. To the extent possible, work will be individual or in two-man squads. (Simons.)

ENEE. 124.* Electronic Circuit II. (4)

Four hours of lecture per week. (See ENEE 125 for related laboratory course.) Prerequisite, ENEE 122. Corequisites, ENEE 132, ENEE 123, and ENEE 125. Required of seniors in electrical engineering. Continuation of ENEE 122. Electron tubes and transistors in continuous-wave and pulse applications Class-C circuits; modulation and detection; pulse generation, delay, and storage; feedback amplifiers. (Simons.)

ENEE. 125.* Electronics Laboratory II. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 124. Required of seniors in electrical engineering. Laboratory to be taken in association with ENEE 124. Specification and design of electronic circuits. Students work as individuals or as responsible members of a project team. (Simons.)

ENEE. 144. Electronic Circuits. (3)

Three hours of lecture per week. Prerequisite, ENEE 60 or equivalent knowledge of circuit theory, or consent of the instructor. This course is intended for students in the Physical Sciences, and for engineering students requiring additional study of electronic circuits. Credit not normally given for this course in an electrical engineering major program. (ENEE 123 or 125 may optionally be taken as an associated laboratory, as is appropriate.) P-n junctions, transistors; vacuum tubes; biasing and operating point stability; switches, large-signal analysis; models; small signal analysis; frequency response; feedback and multistage amplifiers; pulse and digital circuits. (Simons.)

* Graduate Credit not given to E. E. Majors for these courses.

ENEE. 146. Electronics for Life Scientists. (3)

Two hours of lecture and two hours of laboratory per week. Laboratory fee, $5.00. Prerequisites, college algebra and a physics course including basic electricity and magnetism. Not accepted for credit in an electrical engineering major program. The concept of an instrumentation system with emphasis upon requirements for transducers, amplifiers, and recording devices; design criteria and circuitry for power supplies, amplifiers, and pulse equipment; specific instruments used for biological research; problems of shielding against hum and noise pickup and other interference problems characteristic of biological systems. (Ferris.)

ENEE. 148. Electronic Instrumentation for Physical Science (3)

Two hours of lecture and two hours of laboratory per week. Laboratory fee, $5.00. Prerequisites, ENEE 60 or 120. Physics 104 or equivalent, or consent of the instructor. The concept of instrumentation systems from sensor to readout; discussion of transducers; system dynamics, precision, and accuracy; measurement of electrical parameters; direct, differential, and potentiometric measurements; bridge measurements; time and frequency measurements; waveform generaton and display. (Ferris.)

ENEE. 150. Network Synthesis. (3)

Three hours of lecture per week. Prerequisite, ENEE 120. Positive real functions; synthesis of driving point impedances; network functions; approximation methods; Chebychev and Butterworth filters. (Chu.)

ENEE. 154. Feedback Control Systems. (3)

Three hours of lecture per week. Prerequisites, Math. 66 and ENEE 122. (See ENEE 155 for related laboratory course.) Feedback system operation and design; stability criteria; basic design techniques; correlation of time and frequency domain concepts; flow graph algebra; system synthesis to a variety of specifications. (Larson.)

ENEE. 155. Feedback Control Systems Laboratory. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 154. Projects to enhance the student's understanding of feedback control systems and familiarize him with some of the devices used in the control field. (Martin.)

ENEE. 172. Advanced Pulse Techniques. (3)

Three hours of lecture per week. (See ENEE 173 for related laboratory course.) Prerequisite, ENEE 124 or ENEE 146 or equivalent. Bistable, monstable, and astable circuits; sweep circuits; synchronization; counting; gates; comparators; magnetic core circuits; semiconductor and vacuum tube circuits. (Schulman.)

ENEE. 173. Pulse Techniques Laboratory. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 172 or ENEE 164 and permission of the instructor. Experiments on switching circuits; bistable, monstable, and astable circuits; sweep circuits; gates; comparators. (Simons.)

ENEE. 174. Advanced Radio Engineering. (3)

Three hours of lecture per week. Corequisite. ENEE 124. (See ENEE 175 for related laboratory course.) The coupling coefficient concept: high-frequency effects: design and optimization of amplifiers: stability considerations: gain limitations: noise figure: design of harmonic generators; design of stable oscillators. (Wagner.)

ENEE. 175. Advanced Radio Engineering Laboratory. (1)

Two hours of laboratory per week. Laboratory fee, $5.00. Corequisite, ENEE 174. Experiments on multiple tuned amplifiers. noise figure measurements; class-C amplifiers: varactors; oscillators; modulators. Projects. (Friedman.)

ENEE. 190. Mathematical Foundations of Circuit Theory. (3)

Three hours of lecture per week. Prerequisite. ENEE 120 and Math. 22, or equivalent. This course is intended primarily for students preparing for graduate study. Review of determinants: linear equations: matrix theory; eigenvalues: theory of complex variables; inverse Laplace transforms. Applications are drawn primarily from circuit analysis. (Marcovitz.)

For Graduates

ENEE. 202. 203. Transients in Linear Systems. (3,3)

Two lectures per week. Prerequisite. undergraduate major in electrical or mechanical engineering or physics. Operational circuit analysis: the Fourier integral: transient analysis of electrical and mechanical systems and electronic circuits by the Laplace transform method. (Wagner.)

ENEE. 204. Advanced Electronic Circuit Design. (3)

Two lectures per week. Prerequisites. ENEE 124 or consent of the instructor. Comparison of bipolar and field effect transistors: detailed frequency response of single and multistage amplifier: design of feedback amplifiers; d-c coupling techniques: design of multistage tuned amplifiers. (Simons.)

ENEE. 212. 213. Servomechanism. (3,3)

Two lectures per week. Prerequisites. ENEE 154 and ENEE 202, or equivalent. Linear control systems with deterministic and stochastic inputs; nonlinear control systems: time and frequency domain techniques. (Price.)

ENEE. 230. Mathematics of Circuit Analysis. (3)

Two lectures per week. Prerequisite. undergraduate circuit theory and advanced calculus. Determinants: linear equations: matrix theory: eigenvalues; theory of complex variables; inverse Laplace transforms: applications to circuit analysis. (Marcovitz.)

ENEE. 232. 233. Network Synthesis. (3,3)

Two lectures per week. Prerequisite. ENEE 231 or equivalent. Design of driving-point and transfer impedance functions with emphasis on the transfer loss and phase of minimum-phase networks: flow diagrams: physical network characteristics. including relations existing between the real and imaginary components of network functions: modern methods of network synthesis. (Basham.)

ENEE. 234. Graph Theory in Network Analysis. (3)

Two lectures per week. Prerequisite. ENEE 230. Linear graph theory as applied to electrical networks: cut sets and tie sets; incidence matrices: trees, branches, and mazes: development of network equations by matrix and index notation; network characteristic equations for natural circuit behavior; signal flow graph theory and Mason's rule; stability of active two-port networks. (Wagner.)

ENEE. 235. Applications of Tensor Analysis. (3)

Two lectures per week. Prerequisite. ENEE 202 or ENEE 230. The mathematical background of tensor notation which is applicable to electrical engineering problems. Applications of tensor analysis to electric circuit theory and to field theory. (Wagner.)

ENEE. 238. Sampled Data Control Systems. (3)

Two lectures per week. Prerequisite. undergraduate or graduate preparation in linear feedback control theory. Z-transform and modified Z-transform method of analysis; root locus and frequency response method of analysis; discrete and continuous compensation; analysis with finite pulse width; digital control systems. (Price.)

ENEE. 280. Electronic Properties of Semiconductors. (3)

Three hours per week. Prerequisites, ENEE 182, or Math. 66 and Phys. 153, or equivalents. Properties of crystals; elementary topics from quantum mechanics: energy bands: electron transport theory; conductivity and Hall effect; statistical distributions: Fermi Level: impurities; non-equilibrium carrier distributions; normal modes of vibration: effects of high electric fields; p-n junction theory, avalanche breakdown; tunneling phenomena: surface properties. (Bullis.)

ENEE. 282. Technology of Semiconductor Devices and Materials. (3)

Three hours per week. Prerequisites, ENEE 182 or Phys. 153 or ENEE 290. Basic processes involved in the fabrication of transistors and other semiconductor devices; crystal growth and epitaxy; crystal orientation; purification and doping of crystals; diffusion; electrical and optical properties: photo-resist techniques; oxide passivation; contacts; device assembly and packaging. Emphasis is on silicon but other materials of engineering significance are considered. (Bullis.)

ENEE. 284. Semiconductor Device Models. (3)

Two lectures per week. Prerequisite, ENEE 182 and ENEE 234, or equivalents. Single-frequency models for transistors: small-signal and wide-band models for general non-reciprocal devices; hybrid-pi and tee models for transistors; relationship of models to transistor physics; synthesis of wide-band models from terminal behavior: computer utilization of models; models for other semiconductor devices. (Tompkins.)

INFORMATION SCIENCES

For Graduates and Advanced Undergraduates

ENEE. 142.* Engineering Probability. (2)

Two hours of lecture per week. Prerequisites, Math. 22, ENEE 90. Required of electrical engineering majors. Probability theory, discrete and continuous; statistical distribution functions and their parameters; applications to electrical engineering. (Ginnings.)

ENEE. 158. Signal Analysis, Modulation, and Noise. (3)

Three hours of lecture per week. Prerequisites, ENEE 122, ENEE 142. Signal transmission through networks; transmission in the presence of noise; statistical methods of determining error rate and transmission effects; modulation schemes. (Price.)

ENEE. 160. Electronic Analog Computers. (3)

Three hours of lecture per week. Prerequisite, ENEE 122. Programming the analog computer; analog computing components; error analysis, repetitive operation; synthesis of systems using the computer; hybrid computer systems. (Chu.)

ENEE. 162. Logic of Digital Computers. (3)

Two hours of lecture and two hours of laboratory per week. Laboratory fee, $5.00. Prerequisites, Math. 21, ENEE 80, or equivalent. Symbolic logic and Boolean Algebra; switching circuits; simplification; binary and other number representations and codes; storage elements defined logically; basic sequential circuits; digital systems. (Pugsley.)

ENEE. 164. Digital Computer Technology. (3)

Three lectures per week. (See ENEE 173 for related laboratory.) Prerequisites, ENEE 122, ENEE 162. Organization of electronic digital computers; electronic subassemblies; integrated circuits; digital storage; digital and analog magnetic recording; analog-digital conversion. (Tompkins.)

For Graduates

ENEE. 218, 219. Signal Analysis and Noise. (3,3)

Two lectures per week. Prerequisites, equivalent to ENEE 158. Mathematical description of noise; spectral analysis; noisy signal detection; optimum linear systems. (Ginnings.)

ENEE. 220. Statistical Communication Theory. (3)

Two lectures per week. Prerequisite, ENEE 219. Statistical description of signals; testing statistical hypotheses; likelihood testing; statistical estimation of signal parameters. (Ginnings.)

ENEE. 221. Information Theory. (3)

Two lectures per week. Prerequisite, Math. 133 or equivalent. Information measure; channels; source encoding; error correcting codes. (Marcovitz.)

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* Graduate Credit not given to E. E. Majors for these Courses.

ENEE. 262. Switching Theory I. (3)

Two lectures per week. Prerequisite. ENEE 162 or consent of instructor. Applications of Boolean algebra to combinational switching circuits; symmetric functions; majority and threshold networks; function decomposition: minimization; prime implicants and algorithms for finding them; minimal and nearly minimal covers. (Pugsley.)

ENEE. 263. Switching Theory II. (3)

Two lectures per week. Prerequisite. ENEE 262 or consent of instructor. Models for sequential machines; equivalence; state minimization; incompletely specified machines; linear sequential machines; regular expressions, partitions, and state assignment. (Pugsley.)

ENEE. 270. Digital Computer Design. (3)

Two lectures per week. Prerequisite. ENEE 162 or equivalent. Introduction to design techniques for digital computers; review of Boolean algebra; digital arithmetic; logic circuits; digital memories; design of computer elements, arithmetic unit, and control unit. A simple digital computer will actually be designed during the course. (Chu.)

ENEE. 272. Advanced Digital Computer Design. (3)

Two lectures per week. Prerequisites, ENEE 270 or equivalent; knowledge of computer programming. Computer design languages; computer organization; computer design by language translation; integrated logic circuit design; digital memories including read-only and associative memories; case studies of computer designs. (Chu.)

ENEE. 274. Digital Systems Engineering. (3)

Two lectures per week. Prerequisite. ENEE 270. Systems aspects of digital-computer-based systems; data flow analysis; system organization; control languages; consoles and displays; remote terminals; software-hardware tradeoff; system evaluation; case studies from selected applications areas such as data acquisition and reduction, information storage, or the like. (Pugsley.)

ENEE. 276. Computers for Differential Equation Solution. (3)

Two lectures per week. Prerequisite, ENEE 162, knowledge of elementary differential equations, numerical methods, and programming. Mechanistic methods for differential equation solution; application of analog or hybrid computers for the purpose; digital differential analyzers; digital-analog simulation on a general-purpose digital computer. MIMIC Language and examples of its use. Class will run simulation program on an IBM 7094 or similar computer. (Chu.)

RESEARCH, SEMINARS, AND SPECIAL TOPICS

For Graduates and Advanced Undergraduates

ENEE. 180. Topics in Electrical Engineering. (3)

Prerequisite. permission of the instructor. May be taken for repeated credit up to a total of 6 credits. with the permission of the student's advisor and the instructor. Selected topics from the literature of modern electrical engineering. (Jones.)

For Graduates

ENEE. 222. GRADUATE SEMINAR. (1-3)

Prerequisite, consent of instructor. Seminars are held on topics such as microwave engineering, radiation engineering, non-linear circuit analysis, tensor analysis, and other topics of current interest. May be taken for repeated credit. (Basham.)

ENEE. 223. ADVANCED TOPICS IN ELECTRICAL ENGINEERING. (3)

Prerequisite, permission of the instructor. Selected topics from the current literature of electrical engineering. May be taken for repeated credit. (Basham.)

ENEE. 399. ELECTRICAL ENGINEERING RESEARCH.

Prerequisite, consent of thesis supervisor. Six semester hours of credit in ENEE 399 are required of M. S. degree candidates and a minimum of eighteen semester hours are required of Ph.D. candidates. A thesis covering an approved research problem and written in conformity with the regulations of the Graduate School is a partial requirement for either the degree of Master of Science or the degree of Doctor of Philosophy in electrical engineering. (Basham.)

ENTOMOLOGY

Professors: BICKLEY, CORY (EMERITUS), DITMAN, JONES AND LANGFORD.

Associate Professors: HARRISON, MESSERSMITH, AND STEINHAUER.

Assistant Professor: MENZER.

The Department of Entomology offers work toward the degrees of Master of Science and Doctor of Philosophy. Candidates for the Ph.D. degree who are not employed by the Department are expected to register for a minimum of 24 semester hours credit during two semesters at College Park.

For Graduates and Advanced Undergraduates

ENT. 100. ADVANCED APICULTURE. (3)

Second semester. One lecture and two three-hour laboratory periods a week. Prerequisite, Ent. 4. The theory and practice of apiary management. Designed for the student who wishes to keep bees or requires a practical knowledge of bee management. $3.00 Lab fee. (Abrams.)

ENT. 105. MEDICAL ENTOMOLOGY. (3)

First semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Ent. 1 or consent of the Department. A study of insects and related anthropods that affect the health and comfort of man directly and as vectors of disease. In discussions of the control of such pests the emphasis will be upon community sanitation. $3.00 Lab fee. (Jones.)

ENT. 107. INSECTICIDES. (2)

Second semester. Prerequisite, consent of the Department. The development and use of contact and stomach poisons, fumigants and other important chemicals, with reference to their chemistry, toxic action, compatibility, and host injury. Recent research emphasized. (Menzer.)

ENT. 109. INSECT PHYSIOLOGY. (2)

Second semester. (Not offered 1967-68.) Two lectures and occasional demonstrations. Prerequisite, consent of the Department. The functioning of the insect body with particular reference to blood, circulation, digestion, absorption, excretion, respiration, reflex action and the nervous system, and metabolism. (Jones.)

ENT. 116. INSECT PESTS OF ORNAMENTALS AND GREENHOUSE PLANTS. (3)

Second semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Bot. 1 and Zool. 1. The recognition, biology, and control of insects injurious to plants grown in ornamental planting, nurseries, and other glass. $3.00 Lab fee. (Staff.)

ENT. 119. INSECT PESTS OF DOMESTIC ANIMALS. (2)

First semester. One lecture and one two-hour laboratory period a week. Prerequisite, Ent. 1 or consent of the Department. The recognition, biology, and control of insects and related arthropods injurious to horses, cattle, hogs, sheep, goats, and poultry. $3.00 Lab. fee. (Staff.)

ENT. 120. INSECT TAXONOMY AND BIOLOGY. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Ent. 1. Introduction to the principles of systematic entomology and the study of all orders and the important families of insects; immature forms considered. $3.00 Lab. fee. (Bickley.)

ENT. S121. ENTOMOLOGY FOR SCIENCE TEACHERS. (4)

Summer session. Five lectures and five two-hour laboratory periods a week. Laboratory fee, $3.00. This course will include the elements of morphology, taxonomy and biology of insects using examples commonly available to high school teachers. It will include practice in collecting, preserving, rearing and experimenting with insects insofar as time will permit. (Staff.)

ENT. 122. INSECT MORPHOLOGY. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Laboratory fee, $3.00. Prerequisite, Ent. 1. A basic study of insect form, structure and organization in relation to function. (Staff.)

ENT. 123. INSECT PHYSIOLOGY. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Laboratory fee, $15.00. Prerequisites, Ent. 1, Chem. 31 or equivalent. Lectures and laboratory exercises on the cuticle, growth, endocrines, muscles, circulation, nerves, digestion, excretion and reproduction in insects. (Jones.)

ENT. 198. SPECIAL PROBLEMS. (1-3)

First and second semesters. Credit and prerequisites, to be determined by the Department. Investigation of assigned entomological problems. (Staff.)

ENT. 199. SEMINAR. (1, 1)

First and second semesters. Prerequisite, senior standing. Presentation of original work, reviews and abstracts of literature. (Staff.)

For Graduates

Ent. 205. Insect Ecology. (2)

Second semester. One lecture and one two-hour laboratory period a week. Prerequisite, consent of the Department. A study of fundamental factors involved in the relationship of insects to their environment. Emphasis is placed on the insect as a dynamic organism adjusted to its surroundings. $3.00 Lab. fee. (Harrison.)

Ent. 206. Culicidology. (2)

Second semester. One lecture and one three-hour laboratory period a week. (Alternate years.) The classification, distribution, ecology, biology, and control of mosquitoes. $3.00 Lab. fee. (Bickley.)

Ent. 207. Advanced Insect Physiology. (4)

Second semester. (Not offered 1967-68.) Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of organic chemistry and Ent. 109 or equivalent. In this course students rear experimental insects, make up reagents and solutions to be used, set up equipment, calibrate it, and make detailed measurements and observations on the functions of selected organ systems. $3.00 Lab. fee. (Jones.)

Ent. 208. Toxicology of Insecticides. (3)

First semester. Three lectures a week. (Alternate years.) A study of the physical, chemical and biological properties of insecticides. Emphasis is placed on the relationship of chemical structure to insecticidal activity and mode of action. Mechanisms of resistance are also considered. (Staff.)

Ent. 210. Entomological Topics. (Credit arranged)

First and second semesters. One lecture or one two-hour laboratory a week for each credit hour. Prerequisite, consent of Department. Lectures, group discussions or laboratory sessions on selected topics such as: Aquatic Insects, Biological Control of Insect, Entomological Literature, Forest Entomology, History of Entomology, Insect Biochemistry, Insect Embryology, Immature Insects, Insect Behavior, Principles of Economic Entomology, Insect Communication, Principles of Entomological Research. (Staff and visiting lecturers.)

Ent. 301. Advanced Entomology. (1-6)

Credit and prerequisites to be determined by the Department. First and second semesters. Studies of minor problems in morphology, physiology, taxonomy and applied entomology, with particular reference to the preparation of the student for individual research. (Staff.)

Ent. 399. Research.

First and second semesters. Required of graduate students majoring in entomology. This course involves research on an approved project. A dissertation suitable for publication must be submitted at the conclusion of the studies as a part of the requirements for an advanced degree. (Staff.)

INSTITUTE FOR FLUID DYNAMICS AND APPLIED MATHEMATICS

The Institute for Fluid Dynamics and Applied Mathematics is a center for fundamental theoretical and experimental research in the physical and

mathematical sciences. It plays a vital role in the University program of higher education by providing facilities for predoctoral and postdoctoral study. Further, it provides an important link between the University and the broad scientific and technological community.

Investigations in applied mathematics traditionally have centered on partial differential equations of mathematical physics, specifically initial value, boundary value and eigenvalue problems and their numerical treatment. More recently, attention has been drawn to current questions in ordinary differential equations such as hereditary dependence and control theory, and to mathematical methods in statistical mechanics and theoretical biology. Theoretical studies of gas dynamics and plasma dynamics are carried out in conjunction with laboratory investigations employing facilities such as shock tubes and a thermal plasma device (Q-machine). Applications to astrophysics, e.g., the elemental abundance problem, to nonlinear mechanics and to space physics engage the attention of the staff. Research in meteorology as an extension of fluid dynamics to planetary atmospheres encompasses both theoretical and experimental techniques. The Institute's research program is partially supported by outside contracts and grants.

Staff members are available for thesis direction of graduate students pursuing advanced degrees in various departments of the University. Approximately 100 master's and Ph.D. degrees were earned during the period 1951-65 in the departments of Mathematics, Physics and Astronomy, Mechanical Engineering and Aerospace Engineering under the direction of Institute faculty. In addition, staff members have taught many graduate and undergraduate courses in other departments of the University. Fellowships and research graduate assistantships are available to support the studies of qualified graduate students, and the Institute offers its facilities and financial support both to post-doctoral fellows and senior scholars on leave from other institutions.

Institute staff members work closely with faculty and staff of other University departments on problems of mutual interest, and with scientists at many governmental and educational institutions in the Washington-Baltimore area.

FOOD SCIENCE

Graduate courses of study in food science leading to the degrees of Master of Science and Doctor of Philosophy are offered under the aegis of the Department of Dairy Science and the Department of Horticulture. Certain courses are offered also by the Departments of Animal Science and Poultry Science. The student may pursue work in the chemical, bacteriological, and nutritional aspects of dairy products and the industrial phases of milk processing; or in the chemical physical, bacteriological and nutritional aspects of processed vegetables and fruits.

Students interested in food science should consult either the Department of Dairy Science or the Department of Horticulture for information on specific departmental requirements. (See course listings under Dairy Science, page 89, and Horticulture, page 184.)

FOREIGN LANGUAGES AND LITERATURE

Professors: Bingham, Falls (emeritus), Goodwyn, Jones, Nemes, Quynn, Prahl, Rand, and Zucker (Emeritus).

Visiting Professors: Bettex and Iwry.

Associate Professors: Parsons (Acting Head), Alter, Dobert, Gramberg. Hering, Kramer (Emeritus), Mendeloff, Rosenfield, and Rovner.

Assistant Professors: Bridgers, Boyd, Chen, Demaitre, Greenberg, Hall, Hitchcock, Kelly, Miller, Moeller, Norton, Roswell, Vassylkivsky, and Zimmerman.

MASTER OF ARTS

Candidates must pass, in addition to written examinations in the courses pursued, a written examination based on the reading lists in their respective fields of French, German and Spanish, established by the Department. The examination will test the general familiarity of the candidate with his respective field and his powers of analysis and criticism. The oral examination will deal chiefly with the field of his thesis.

DOCTOR OF PHILOSOPHY

Candidates must pass a comprehensive written examination at least one year before the degree is awarded. This examination will include linguistics and each of the major literary fields.

Attention is called to the courses in Comparative Literature.

For Graduates and Advanced Undergraduates

Foreign Language. 101. Introduction to Linguistics. (3)

Introduction to the basic concepts of modern descriptive linguistics. Phonology, morphology, syntax. Examinations of the methods of comparative linguistics, internal reconstruction, dialect, geography. (Miller.)

Foreign Language. 102. Phonetics and Phonemics. (3)

Training in identification, description, and symbolization of various sounds found in language. Study of scientific techniques for classifying sounds into units which are perpetually relevant for a given language. (Miller.)

FRENCH

French 0. Intensive Elementary French. (Audit)

First and second semesters and summer session. Graduate students should register as auditors only. Intensive elementary course in the French language designed particularly for graduate students who wish to acquire a reading knowledge. (Hall.)

French 101. Applied Linguistics. (3)

The nature of Applied Linguistics and its contributions to the effective teaching of foreign languages. Comparative study of English and French, with emphasis upon points of divergence. Analysis, evaluation and construction of related drills. (Mendeloff.)

French 103-104. Advanced Composition. (3, 3)

First and second semesters. Translation from English into French, free composition, practical study of syntactical structure. (Staff.)

French 107. Introduction to Medieval Literature. (3)

French literary history from the ninth through the fifteenth century, selected readings from representative texts. (Mendeloff.)

French 111. French Literature of the Sixteenth Century. (3)

The Renaissance in France; humanism; Rabelais and Calvin; the Pleiade; Montaigne. (Staff.)

French 115-116. French Literature of the Seventeenth Century. (3, 3)

First and second semesters. First semester: Descartes, Pascal, Corneille, Racine. Second semester: the remaining great classical writers, with special attention to Moliere. (Quynn, Rosenfield.)

French 125-126. French Literature of the Eighteenth Century. (3, 3)

First and second semesters. First semester: development of the philosophical and scientific movement; Montesquieu. Second semester: Voltaire, Diderot, Rousseau. (Bingham.)

French 131-132. French Literature of the Nineteenth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Romanticism to Symbolism. Second semester: the major prose writers of the same period. (Bingham, Quynn.)

French 141-142. French Literature of the Twentieth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Symbolism to the present time. Second semester; the contemporary novel. (Alter.)

French 171-172. French Civilization. (3, 3)

First and second semesters. French life, customs, culture, traditions. First semester: the historical development. Second semester: present-day France. (Rosenfield, Bingham.)

For Graduates

French 201. The History of the French Language. (3)

A rapid survey of the major phenomena of French linguistic history, considered from the internal and external points of view. Introduction to linguistic terminology. Prerequisite, some knowledge of Latin desirable. (Mendeloff.)

French 203. Comparative Romance Linguistics. (3)

A comparative study of the principal Romance languages: phonology, morphology, syntax, lexicon. (Mendeloff.)

French 207. Elementary Old French. (3)

An introduction to Old French accidence and vocabulary through the reading of the *Chanson de Roland*. Readings in modern French of representative works of Old French literature. (Staff.)

French 208. Old French Phonology and Morphology. (3)

Phonological changes from Vulgar Latin to Old French; the resultant Old French accidence and morphological changes from Vulgar Latin to Old French. Prerequisite, some knowledge of Latin desirable. (Staff.)

French 209. Medieval French Culture. (3)

Extensive readings in modern French translations of the masterpieces of Old French literature; lectures and readings on the historical and social setting of these works in feudalism. (Staff.)

French 210. Elementary Old Provencal. (3)

The essentials of Old Provencal phonology and morphology necessary to reading; readings in Old Provencal lyric poetry and other representative literary works. Prerequisite, some knowledge of Latin desirable. (Staff.)

French 211-212. Seminar in French Classicism. (3, 3)

Origin and underlying ideas of classicism will be discussed. Main classic writers to be studied, with shifting emphasis from year to year. (Quynn.)

French 220-221. The Age of Enlightenment. (3, 3)

The literature of ideas from Bayle to Condorcet. (Bingham.)

French 230. Seminar in Romanticism. (3)

Sources and theories of French romanticism will be studied, along with works of major French romantic writers. Different writers or genres will be stressed from year to year. (Quynn.)

French 235-236. The Realistic Novel in the Nineteenth Century. (3, 3)

The main works of Balzac, Stendhal, Flaubert, the Goncourts, Zola, Maupassant, and Daudet. (Alter.)

French 243-244. The Contemporary French Theater. (3, 3)

The most important writers and trends in French drama from the end of the nineteenth century to the present. (Staff.)

French 245-246. Seminar in the Contemporary Novel. (3, 3)

Critical study of the entire work of a major twentieth century novelist, such as Proust, Gide, Mauriac, Duhamel. Usually a different novelist will be treated in the second semester. (Staff.)

French 251-252. The History of Ideas in France. (3, 3)

Analysis of currents of ideas as reflected in French literature. First semester, 17th and 18th centuries. Second semester, 19th and 20th centuries. Conducted in English. (Rosenfield.)

French 271-272. Advanced Writing and Stylistics. (3, 3)

Composition, translation, *explication de textes* of both prose and poetry. Prerequisite, French 121 or 122 or their equivalent. (Staff.)

French 281-282. Reading Course. (3, 3)

Designed to give graduate students a background of a survey of French literature. Extensive outside readings, with reports and periodic conferences. (Staff.)

French 291-292. Seminar. Topic to be determined. (3, 3)

(Staff.)

French 399. Research. (1-6)

Credits determined by work accomplished. Guidance in preparation of master's and doctoral theses. Conferences. (Staff.)

GERMAN

For Graduates and Advanced Undergraduates

German 0. Intensive Elementary German. (Audit)

First and second semesters and summer session. Graduate students should register as auditors only. Intensive elementary course in the German language designed particularly for graduate students who wish to acquire a reading knowledge. (Hering.)

German 103-104. Advanced Composition. (3, 3)

First and second semesters. Translation from English into German. free composition, letter writing. (Staff.)

German 125-126. German Literature of the Eighteenth Century. (3, 3)

First and second semesters. The main works of Klopstock, Wieland, Lessing. Herder, Goethe, Schiller. (Hering, Staff.)

German 131-132. German Literature of the Nineteenth Century. (3, 3)

First and second semesters. Study of the literary movements from romanticism to naturalism. (Prahl, Staff.)

German 141-142. German Literature of the Twentieth Century. (3, 3)

First and second semesters. Prose and dramatic writings from Gerhart Hauptmann to the present. Modern literary and philosophical movements will be discussed. (Dobert, Staff.)

German 171-172. German Civilization. (3, 3)

First and second semesters. Study of the literary, educational, artistic traditions: great men, customs, and general culture. (Dobert, Staff.)

German 191. Bibliography and Methods. (3)

Second semester. Especially designed for German majors. (Staff.)

Attention is called to Comp. Lit. 106, *Romanticism in Germany,* and Comp. Lit. 107, *The Faust Leg nd in English and German Literature.*

For Graduates

The requirements of students will determine which courses will be offered.

German 201. History of the German Language. (3)
Lectures on the evolution of modern German. Reading and analysis of selected illustrative texts. (Jones.)

German 203. Gothic. (3)
An introduction to historical Germanic linguistics. A grammatical analysis and reading of selections from the Gothic Bible. (Jones.)

German 204. Old High German. (3)
A study of Old High German grammar, and readings from the literature of the period. (Jones.)

German 205. Middle High German. (3)
Grammar and readings in Middle High German literature. (Jones.)

German 207. Literature of Old High German and Middle High German. (3)
A study of the literature of the Old High German and Middle High German periods. (Jones.)

German 211-212. Literature of the Sixteenth and Seventeenth Centuries. (3, 3)
Study of the Reformation, Humanism and the Baroque. The main works of Luther, Sachs, Wickram, Fischart, Opitz, Gryphius, Grimmelshausen. (Hering.)

German 224-225. Goethe and his Time. (3, 3)
The main works of Goethe and his contemporaries as reflecting the literary development from Rococo to Biedermeier. (Hering.)

German 226. Schiller. (3)
Study of Schiller's works with emphasis on his dramas. (Prahl.)

German 230. German Romanticism. (3)
Special consideration given to the ideas and the style of romantic writers. (Prahl.)

German 234. The German Drama of the Nineteenth Century. (3)
Kleist, Grabbe, Büchner, Grillparzer, Hebbel, Hauptmann. (Dobert.)

German 250. The German Lyric. (3)
Types of lyrical poetry from "Minnesang" to Symbolism with emphasis on post-Goethean lyricists. (Hering.)

German 281-282. Reading Course. (3, 3)
Designed to give the graduate student a background of a survey of German literature. Extensive outside readings, with reports and periodic conferences. (Dobert.)

German 291-292. Seminar. (3, 3)
Topic to be determined. (Staff.)

German 399. Research. (1-6)
Credits determined by work accomplished. Guidance in preparation of master's and doctoral theses. Conferences. (Staff.)

SPANISH

For Graduates and Advanced Undergraduates

Spanish 101. Applied Linguistics. (3)
Nature of Applied Linguistics and its contribution to the effective teaching of foreign languages. Comparative study of English and Spanish with emphasis upon points of divergence. Analysis, evaluation, and construction of related drills. (Mendeloff.)

Spanish 103-104. Advanced Composition. (3, 3)
First and second semesters. Training in self-expression in Spanish, free composition, writing and speaking. (Goodwyn.)

Spanish 107. Introduction to Medieval Literature. (3)
Spanish literary history from the eleventh through the fifteenth century. Selective readings from representative texts. (Mendeloff, Parsons.)

Spanish 111. Poetry of the Sixteenth and Seventeenth Centuries. (3)
Renaissance, mystics, and baroque poetry. (Goodwyn, Rand.)

Spanish 112. Prose of the Sixteenth and Seventeenth Centuries. (3)
Selected readings in the pastoral, sentimental, picturesque novel and in the Romances of Chivalry. (Goodwyn.)

Spanish 113. Drama of the Sixteenth and Seventeenth Centuries. (3)
Selected plays of Lope de Vega, Calderon de la Barca, Tirso de Molina, and others. (Parsons, Rovner.)

Spanish 114. Lope de Vega. (3)
Selected works of Lope de Vega. (Parsons, Rovner.)

Spanish 115-116. Cervantes. (3, 3)
Renaissance, mystics, and baroque poetry. (Goodwyn, Rand.)

Spanish 125. Literature of the Eighteenth Century. (3)
Reform and neo-classicism: Feijoo and Luzan. (Goodwyn.)

Spanish 131. Nineteenth Century Fiction. (3)
Reading of some of the significant novels of the nineteenth century. (Parsons, Rand.)

Spanish 135. Modern Spanish Poetry. (3)
Significant poets of the nineteenth and twentieth centuries. (Nemes, Rand.)

Spanish 136. Modern Spanish Drama. (3)
Significant plays of the nineteenth and twentieth centuries. (Parsons, Rand.)

Spanish 141-142. Literature of the Twentieth Century. (3, 3)
First semester. Modern Spanish thought in the Generation of 1898 and after. Second semester; the contemporary Spanish novel. (Rand.)

Spanish 161. Spanish-American Fiction. (3)
The novel and short story from the Wars of Independence to the present and their reflection of society in the Hispanic republics of the Western Hemisphere. (Nemes, Rovner.)

Spanish 162. Spanish-American Poetry. (3)
Representative poetry after 1800 and its relation to European trends and writers. (Nemes, Rovner.)

Spanish 163. Spanish-American Essay. (3)
Social and political thought from Bolivar to Vasconcelos and its relationship to social and political conditions in Spanish America. (Nemes, Rovner.)

Spanish 171, 172. Spanish Civilization. (3,3)
A survey of two thousand years of Spanish history, outlining the cultural heritage of the Spanish people, their great men, traditions, customs, art and literature, with special emphasis on the interrelationship of social and literary history. (Rand.)

Spanish 173, 174. Latin-American Civilization. (3,3)
Introduction survey of the cultures of Latin America; the historical-political background and the dominating concepts in the lives of the people.
(Nemes, Rovner.)

For Graduates

Spanish 201. The History of the Spanish Language. (3)
(Mendeloff.)

Spanish 203. Comparative Romance Linguistics. (3)
(Mendeloff.)

Spanish 207. Medieval Spanish Litterature. (3)
(Mendeloff.)

Spanish 215, 216. Seminar: The Golden Age in Spanish Literature. (3,3)
(Goodwyn, Parsons, Rovner.)

Spanish 233. The Novel of the 19th Century. (3)
(Goodwyn, Parsons.)

Spanish 234. The Drama of the 19th Century. (3)
(Goodwyn, Parsons.)

Spanish 237-238. Seminar in Hispanic Poetry (Nineteenth and Twentieth Centuries). (3, 3)
Study of a specific poetic movement such as Romanticism, Modernism, Post-modernism. (Nemes, Rand, Goodwyn.)

Spanish 241-242. Spanish Prose of the Twentieth Century. (3, 3)
The thought and aesthetics of the work of major writers of essay and novel, such as the Generation of 1898 and the novel after 1940. (Rand.)

Spanish 245. The Drama of the Twentieth Century. (3)
Important works of Benavente, Azorin, Garcis, Lorca, Casona, Buero Vallejo and others. (Rand.)

Spanish 263. Colonial Spanish-American Literature. (3)
Colonial thought and writers and their influence in the national literatures. (Nemes.)

Spanish 264. National Spanish-American Literature, Seminar. (3)
Study of a significant work, genre, or groups of works in a certain country or group of countries of Spanish America in relation to other literatures with special emphasis on the interrelationship of social and literary history. (Nemes.)

Spanish 281-282. Reading Course. (3, 3)
Designed to give the graduate student a background of a survey of Hispanic literature. Extensive readings, with reports and periodic conferences. (Staff.)

Spanish 291-292. Seminar. (3, 3)
Topic to be chosen. (Staff.)

Spanish 399. Research. (1-6)
Credits to be determined by work accomplished. Guidance in preparation of master's and doctoral theses. Conferences. (Staff.)

RUSSIAN

Russian 103, 104. Advanced Composition. (3,3)
(Hitchcock.)

Russian 125. Russian Literature of the 18th Century. (3,3)
(Hitchcock.)

Russian 131, 132. Russian Literature of the 19th Century. (3,3)
(Hitchcock.)

Russian 135. Modern Russian Poetry. (3)
(Hitchcock.)

Russian 136. Modern Russian Drama. (3)
(Hitchcock.)

Russian 137. Modern Russian Fiction. (3)
(Hitchcock.)

Russian 141, 142. Soviet Russian Literature. (3,3)
(Hitchcock.)

CHINESE

Chinese 101, 102. Readings from Chinese History. (3, 3)
First and second semesters. Based on an anthology of historians from the Chou to the Ching dynasties. (Chen.)

Chinese 171, 172. Chinese Civilization. (3, 3)
First and second semesters. This course supplements Geography 134 and 135, *Cultural Geography of East Asia*. It deals with Chinese literature, art, folklore, history, government, and great men. Second semester: developments in China since 1911. The course is given in English translation. (Chen.)

HEBREW

Hebrew 101. The Hebrew Bible. (3)
Reading of selected portions of the Pentateuch. (Greenberg.)

Hebrew 102. The Hebrew Bible. (3)
Reading of selected portions of the Prophets. (Greenberg.)

Hebrew 103. Modern Hebrew Literature. (3)
The period of the Haskalah (Enlightenment). (Greenberg.)

Hebrew 104. Modern Hebrew Literature. (3)
The period of the Tehiah (Modern Revival). (Greenberg.)

GEOGRAPHY

Professors: Hu, Van Royen.

Associate Professors Ahnert, Chaves, Deshler (Acting Head).

Assistant Professors: Anderson, Mika, Schmeider, and Wiedel.

The following topics should have been studied by students undertaking graduate work in this discipline.

Morphology
Meteorology and Climate
Map and Air Photo Interpretation
Introductory Cartography
Agricultural or Mineral Resources
General Economic and/or Urban Geography
Methodology
Regional Geography

The course work in geography should amount to twenty-four semester hours. However, for students of competence, gaps in the above topics can be made up by reading course and examination by a member of the graduate faculty.

Supplemental topics which the student should have studied include: Introductory Botany, Economic Principles, and Cultural Anthropology.

The Department requires a student working for the master's degree to show competence in one foreign language approved by the Department.

Students who do not have the above background will be accepted as graduate student in provisional status. Graduate credit will not be given for courses taken to make up deficiencies.

In addition to meeting the general requirements of the Graduate School, candidates for the master's degree in geography are required to have taken successfully: one field course (Geog. 170 or 200, or equivalent), a course in cartography, a course in soils and one seminar. In addition to the final oral examination, the candidate for the master's degree in geography is required to pass satisfactorily a written examination covering the field in which he has worked, his understanding of basic principles, and his power of reasoning.

A graduate student seeking the Doctor of Philosophy degree in geography must take a comprehensive written and oral examination to determine whether he has sufficiently broad and profound knowledge and understanding of the entire field of geography to qualify as a candidate for the doctor's degree.

For Graduates and Advanced Undergraduates

GEOG. 100. REGIONAL GEOGRAPHY OF EASTERN ANGLO-AMERICA. (3)
Prerequisite, Geog. 10, or Geog. 15, or permission of instructor. A study of the cultural and economic geography, and the geographic regions of eastern United States and Canada, including an analysis of the significance of the physical basis for present-day diversification of development, and the historical geographic background. (Staff.)

GEOG. 101. REGIONAL GEOGRAPHY OF WESTERN ANGLO-AMERICA. (3)
Prerequisite, Geog. 10, or Geog. 15, or permission of instructor. A study of western United States, western Canada, and Alaska along the lines mentioned under Geog. 100. (Staff.)

GEOG. 103. GEOGRAPHIC CONCEPTS AND SOURCE MATERIALS. (3)
A comprehensive and systematic survey of geographic concepts designed exclusively for teachers. Stress will be placed upon the philosophy of geography in relation to the social and physical sciences, the use of the primary tools of geography, source materials, and the problems of presenting geographic principles. (Staff.)

GEOG. 104. GEOGRAPHY OF MAJOR WORLD REGIONS. (3)

A geographic analysis of the patterns, problems, and prospects of the world's principal human-geographic regions, including Europe, Anglo-America, the Soviet Union, the Far East, and Latin America. Emphasis upon the causal factors of differentiation and the role geographic differences play in the interpretation of the current world scene. This course is designed especially for teachers. (Staff.)

GEOG. 105. GEOGRAPHY OF MARYLAND AND ADJACENT AREAS. (3)

An analysis of the physical environment, natural resources, and population in relation to agriculture, industry, transport, and trade in the state of Maryland and adjacent areas. (Staff.)

GEOG. 110. ECONOMIC AND CULTURAL GEOGRAPHY OF CARIBBEAN AMERICA. (3)

An analysis of the physical framework, broad economic and historical trends, cultural patterns, and regional diversification of Mexico, Central America, the West Indies, and parts of Colombia and Venezuela. (Chaves.)

GEOG. 111. ECONOMIC AND CULTURAL GEOGRAPHY OF SOUTH AMERICA. (3)

A survey of natural environment and resources, economic developments and cultural diversity of the South American republics, with emphasis upon problems and prospects of the countries. (Chaves.)

GEOG. 120. GEOGRAPHY OF EUROPE. (3)

First and second semester. Agricultural and industrial development of Europe and present-day problems in relation to the physical and cultural setting of the continent and its natural resources. (Ahnert, Von Royen.)

GEOG. 122. ECONOMIC RESERVES AND DEVELOPMENT OF AFRICA. (3)

The natural resources of Africa in relation to agricultural and mineral production; the various stages of economic development and the potentialities of the future. (Deshler.)

GEOG. 125. GEOGRAPHY OF ASIA. (3)

Lands, climates, natural resources and major economic activities in Asia (except Soviet Asia). Outstanding differences between major regions. (Hu.)

GEOG. 130. ECONOMIC AND POLITICAL GEOGRAPHY OF EASTERN ASIA. (3)

Study of China, Korea, Japan, the Philippines: physical geographic setting, population; economic and political geography. Potentialities of major regions and recent developments. (Hu.)

GEOG. 131. ECONOMIC AND POLITICAL GEOGRAPHY OF SOUTH AND SOUTHEAST ASIA. (3)

Study of the Indian subcontinent, Farther India, Indonesia: physical geographic setting; population; economic and political geography. Potentialities of various countries and regions and their role in present Asia. (Hu.)

GEOG. 134. CULTURAL GEOGRAPHY OF CHINA AND JAPAN. (3)

Survey of geographical distribution and interpretation of cultural patterns of China and Japan. Emphasis on basic cultural institutions, outlook on life, unique characteristics of various groups. Trends of cultural change and contemporary problems. (Hu.)

GEOG. 140. GEOGRAPHY OF THE SOVIET UNION. (3)

The natural environment and its regional diversity. Geographic factors in the expansion of the Russian state. The geography of agricultural and industrial production, in relation to available resources, transportation problems, and diversity of population. (Anderson.)

GEOG. 146. REGIONAL GEOMORPHOLOGY. (3)

Regional and comparative morphology, with special emphasis upon Anglo-America. (Ahnert.)

GEOG. 150. HISTORY AND THEORY OF CARTOGRAPHY. (3)

The development of maps throughout history, geographical orientation, coordinates, and map scales. Map projections, their nature, use, and limitations. Principles of representation of features on physical and cultural maps. Modern uses of maps and relationships between characteristics of maps and use types. (Staff.)

GEOG. 151, 152. CARTOGRAPHY AND GRAPHICS PRACTICUM. (3, 3)

First and second semesters. One hour lecture and two two-hour laboratory periods a week. Techniques and problems of compilation, design, and construction of various types of maps and graphs. Relationships between map making and modern methods of production and reproduction. Trips to representative plants. Laboratory work directed toward cartographic problems encountered in the making of non-topographic maps. (Wiedel.)

GEOG. 153. PROBLEMS IN CARTOGRAPHIC REPRESENTATION AND PROCEDURE. (3)

Two hours lecture and two hours laboratory a week. Study of cartographic compilation methods. Principles and problems of symbolization, classification, and representation of map data. Problems of representation of features at different scales and for different purposes. Place-name selection and lettering stickup and map composition. (Staff.)

GEOG. 154. PROBLEMS OF MAP EVALUATION. (3)

Two hours lecture and two hours laboratory a week. Schools of topographic concepts and practices. Theoretical and practical means of determining map reliability, map utility, and source materials. Nature, status, and problems of topographic mapping in different parts of the world. Non-topographic special use maps. Criteria of usefulness for purposes concerned and of reliability. (Wiedel.)

GEOG. 155. PROBLEMS AND PRACTICES OF PHOTO INTERPRETATION. (3)

Two hours of lecture and two hours of laboratory per week. Interpretation of aerial photographs with emphasis on the recognition of landforms of different types and man-made features. Study of vegetation, soil, and other data that may be derived from aerial photographs. Types of aerial photographs and limitations of photo interpretation. (Ahnert.)

Geog. 160. Advanced Economic Geography I. Agricultural Resources. (3)

First semester, alternate years. Prerequisite, Geog. 10, or Geog. 15. The nature of agricultural resources, the major types of agricultural exploitation in the world, and the geographic distribution of certain major crops and animals in relation to the physical environment and economic geographic conditions. Main problems of conservation. (Van Royen.)

Geog. 161. Advanced Economic Geography II. Mineral Resources. (3)

First semester, alternate years. Prerequisite, Geog. 10, or Geog. 15. The nature and geographic distribution of the principal power, metallic, and other minerals. Economic geographic aspects of modes of exploitation. Consequences of geographic distribution and problems of conservation. (Van Royen.)

Geog. 170. Local Field Course. (3)

First semester. Training in geographic field methods and techniques. Field observation of land use in selected rural and urban areas to eastern Maryland. One lecture per week with Saturday and occasional weekend field trips. Primarily for undergraduates. (Ahnert.)

Geog. 180. Methodology and History of Geography. (3)

First semester. For undergraduate and graduate majors in Geography. May be taken also by students with a minimum of 9 hours in systematic and 6 hours in regional geography. A comprehensive and systematic study of the history, nature, and basic principles of geography, with special reference to the major schools of geographic thought; a critical evaluation of some of the important geographical works and methods of geographic research. (Hu.)

Geog. 190. Political Geography. (3)

Geographical factors in national power and international relations; an analysis of the role of "Geopolitics" and "Geostrategy", with special reference to the current world scene. (Chaves.)

Geog. 195. Geography of Transportation. (3)

The distribution of transport routes on the earth's surface; patterns of transport routes; the adjustment of transport routes and media to conditions of the natural environment; transportation centers and their distribution. (Staff.)

Geog. 197. Urban Geography. (3)

Origins of cities, followed by a study of the elements of site and location with reference to cities. The patterns and functions of some major world cities will be analyzed. Theories of land use differentiation within cities will be appraised. (Mika.)

Geog. 198. Topical Investigations. (1-3)

First and second semester. Independent study under individual guidance. Restricted to advanced undergraduate students with credit for at least 24 hours in geography, and to graduate students. Any exception should have the approval of the Head of the Department. (Staff.)

For Graduates

GEOG. 200. FIELD COURSE. (3)

Field work in September, conferences and reports during first semester. For graduate students in geography. Open to other students by special permission of the Head of the Department of Geography. Practical experience in conducting geographic field studies. Intensive training in field methods and techniques and in the preparation of reports. (Staff.)

GEOG. 210, 211. SEMINAR IN THE GEOGRAPHY OF LATIN AMERICA. (3, 3)

First and second semesters. Prerequisites, Geog. 110, 111 or consent of instructor. An analysis of recent changes and trends in industrial development, exploitation of mineral resources and land utilization. (Chaves.)

GEOG. 220, 221. SEMINAR IN THE GEOGRAPHY OF EUROPE AND AFRICA. (3, 3)

First and second semesters. Prerequisites, Geog. 120, 122 or consent of instructor. Analysis of special problems concerning the resources and development of Europe and Africa. (Van Royen, Deshler.)

GEOG. 230, 231. SEMINAR IN THE GEOGRAPHY OF EAST ASIA. (3, 3)

First and second semesters. Analysis of problems concerning the geography of East Asia with emphasis on special research methods and techniques applicable to the problems of this area. (Hu.)

GEOG. 240, 241. SEMINAR IN THE GEOGRAPHY OF THE U.S.S.R. (3, 3)

First and second semesters. Prerequisites, reading knowledge of Russian and Geog. 140 or consent of instructor. Investigation of special aspects of Soviet geography. Emphasis on the use of Soviet materials. (Staff.)

GEOG. 246. SEMINAR IN THE GEOGRAPHY OF THE NEAR EAST. (3)

GEOG. 250. SEMINAR IN CARTOGRAPHY. (Credit arranged.)

First or second semester. The historical and mathematical background of cartographic concepts, practices and problems, and the various philosophical and practical approaches to cartography. Discussions will be supplemented by the presentation of specific cartographic problems investigated by the students. (Staff.)

GEOG. 260. ADVANCED GENERAL CLIMATOLOGY. (3)

First semester. Prerequisite, Geog. 41, or consent of instructor. Advanced study of elements and controls of the earth's climates. Principles of climatic classification. Special analysis of certain climatic types. (Staff.)

GEOG. 261. APPLIED CLIMATOLOGY. (3)

Second semester. Prerequisite, Geog. 41, or consent of instructor. Study of principles, techniques, and data of micro-climatology, physical and regional climatology relating to such problems and fields as transportation, agriculture, industry, urban planning, human comfort, and regional geographic analysis. (Staff.)

Geog. 262, 263. Seminar in Meteorology and Climatology. (3, 3)
First and second semesters. Prerequisite, consent of instructor. Selected topics in meteorology and climatology chosen to fit the individual needs of advanced students. (Staff.)

Geog. 280. Geomorphology. (3)
Second semester. An advanced comparative study of selected geomorphic processes and land forms; theories of land forms evolution and geomorphological problems. (Van Royen.)

Geog. 290, 291. Selected Topics in Geography. (1-3)
First and second semesters. Prerequisite, joint consent of adviser and Head of the Department of Geography. Readings and discussion on selected topics in the field of geography. (Staff.)

Geog. 399. Thesis Research.
(Credit to be arranged.) First and second semesters; summer session. (Staff.)

GOVERNMENT AND POLITICS

Professors: Plischke, Anderson, Burdette, Dillon, and Harrison.

Associate Professors: Byrd, Hathorn, Hsueh, Jacobs, and McNelly.

Assistant Professors: Claude, Conway, Koury, Piper, and Wolfe.
Lecturer: Barber.

The Department of Government and Politics offers a graduate course of study leading to the degree of Master of Arts and the degree of Doctor of Philosophy.

For the master's degree, the student may either pursue a general program in government and politics or he may specialize in international affairs or in public administration. In addition to the completion of a minimum of 24 semester hours credit of formal course work (excluding thesis credit) in the major and minor fields combined, the master's candidate is required to demonstrate in a written comprehensive examination satisfactory competence in graduate course work in the major field and to write and defend in an oral examination a thesis acceptable to the Department. There is no language requirement for the M. A. degree.

For the doctoral degree, the student may pursue any one of three programs; (1) a general program in government and politics; (2) a specialized program in international affairs; or (3) a specialized program in public administration. The doctoral candidate is required to demonstrate in a written comprehensive examination satisfactory competence in five fields of government and politics, the required and elective fields in each case depending upon the particular program pursued. No candidate may attempt the comprehensive examination prior to the fulfillment of the language requirement

for the doctorate, and no candidate may attempt the comprehensive examination more than twice. The following languages are approved for the Ph.D. requirement: French, German, Russian, Spanish, Chinese, Japanese, and Arabic. One of the languages must be either French or German. No two languages offered may be in the same language family, and no student may offer his native language. The completion of a dissertation acceptable to the Department, and defended in oral examination, is the final Ph.D. requirement.

Additional information respecting requirements and procedures may be obtained from the Department, described in detail in a specially prepared Manual of Instructions for Graduate Study in Government and Politics.

For Graduates and Advanced Undergraduates

G. & P. 101. INTERNATIONAL POLITICAL RELATIONS. (3)
Prerequisite, G. & P. 1. A study of the major factors underlying international relations, the methods of conducting foreign relations, the foreign policies of the major powers, and the means of avoiding or alleviating international conflicts. (Staff.)

G. & P. 102. INTERNATIONAL LAW. (3)
Prerequisite, G. & P. 1. A study of the basic character, general principles, and specific rules of international law, with emphasis on recent and contemporary trends in the field and its relation to other aspects of international affairs. (Harrison, Piper.)

G. & P. 103. CONTEMPORARY AFRICAN POLITICS. (3)
Prerequisite, G. & P. 1. A survey of contemporary developments in the international politics of Africa, with special emphasis on the role of an emerging Africa in world affairs. (Onyewu.)

G. & P. 104. INTER-AMERICAN RELATIONS. (3)
Prerequisite, G. & P. 1. An analytical and historical study of the Latin-American policies of the United States and of problems in our relations with individual countries, with emphasis on recent developments. (Harrison, Barber.)

G. & P. 105. RECENT FAR EASTERN POLITICS. (3)
Prerequisite, G. & P. 1. The background and interpretation of recent political events in the Far East and their influence on world politics. (McNelly, Hsue.)

G. & P. 106. AMERICAN FOREIGN RELATIONS. (3)
Prerequisite, G. & P. 1. The principles and machinery of the conduct of American foreign relations, with emphasis on the Department of State and the Foreign Service, and an analysis of the major foreign policies of the United States. (Plischke, Barber, Staff.)

G. & P. 107. CONTEMPORARY MIDDLE EASTERN POLITICS. (3)
Prerequisite, G. & P. 1. A survey of contemporary developments in the international politics of the Middle East, with special emphasis on the role of emerging Middle East nations in world affairs. (Koury.)

G. & P. 108. INTERNATIONAL ORGANIZATION. (3)

Prerequisite, G. & P. 1. A study of the objectives, structure, functions, and procedures of international organizations, including the United Nations and such functional and regional organizations as the Organization of American States. (Plischke, Barber.)

G. & P. 109. FOREIGN POLICY OF THE USSR. (3)

Prerequisite, G. & P. 1. A study of the development of the foreign policy of the Soviet Union, with attention paid to the forces and conditions that make for continuities and changes from Tsarist policies. (Jacobs.)

G. & P. 110. PRINCIPLES OF PUBLIC ADMINISTRATION. (3)

Prerequisite, G. & P. 1. A study of public administration in the United States, giving special attention to the principles of organization and management and to fiscal personnel, planning, and public relations practices. (Dillon, Staff.)

G. & P. 111. PUBLIC PERSONNEL ADMINISTRATION. (3)

Prerequisite, G. & P. 110 or B. A. 160. A survey of public personnel administration, including the development of merit civil service, the personnel agency, classification, recruitment, examination techniques, promotion, service ratings, training, discipline, employee relations, and retirement. (Staff.)

G. & P. 112. PUBLIC FINANCIAL ADMINISTRATION. (3)

Prerequisite, G. & P. 110 or Econ. 142. A survey of governmental financial procedures, including processes of current and capital budgeting, the administration of public borrowing, the techniques of public purchasing, and the machinery of control through pre-audit and post-audit. (Staff.)

G. & P. 113. GOVERNMENTAL ORGANIZATION AND MANAGEMENT. (3)

Prerequisite, G. & P. 110. A study of the theories of organization and management in American government with emphasis on new trends, experiments, and reorganizations. (Dillon.)

G. & P. 120. PROBLEMS IN POLITICAL BEHAVIOR. (3)

Prerequisite, G. & P. 1. The problem approach to political behavior with emphasis on theoretical and empirical studies on selected aspects of the political process. (Staff.)

G. & P. 124. LEGISLATURES AND LEGISLATION. (3)

Prerequisite, G. & P. 1. A comprehensive study of legislative organization, procedure, and problems. The course includes opportunities for student contact with Congress and with the Legislature of Maryland. (Hathorn, Conway.)

G. & P. 131. INTRODUCTION TO CONSTITUTIONAL LAW. (3)

Prerequisite, G. & P. 1. A systematic inquiry into the general principles of the American constitutional system, with special reference to the role of the judiciary in the interpretation and enforcement of the federal constitution. (Hathorn, Staff.)

G. & P. 132. CIVIL RIGHTS AND THE CONSTITUTION. (3)

Prerequisite, G. & P. 131. A study of civil rights in the American constitutional context, emphasizing freedom of religion, freedom of expression, minority discrimination, and the rights of defendants. (Hathorn, Staff.)

G. &. P. 133. THE JUDICIAL PROCESS. (3)

Prerequisite, G. & P. 1. An examination of judicial organization in the United States at all levels of government, with some emphasis on legal reasoning, legal research, and court procedures. (Byrd.)

G. & P. 141. HISTORY OF POLITICAL THEORY. (3)

Prerequisite, G. & P. 1. A survey of the principal political theories set forth in the works of writers from Plato to Bentham. (Anderson, Byrd, Claude.)

G. & P. 142. RECENT POLITICAL THEORY. (3)

Prerequisite, G. & P. 1. A study of 19th and 20th century political thought, with special emphasis on recent theories of socialism, communism, and fascism. (Anderson, Byrd, Claude.)

G. & P. 144. AMERICAN POLITICAL THEORY. (3)

Prerequisite, G. & P. 1. A study of the development and growth of American political concepts from the colonial period to the present. (Anderson.)

G. & P. 145. RUSSIAN POLITICAL THOUGHT. (3)

Prerequisite, G. & P. 1. A survey and analysis of political ideas in Russia and the Soviet Union from early times to the present. (Anderson.)

G. & P. 154. PROBLEMS OF WORLD POLITICS. (3)

Prerequisite, G. & P. 1. A study of governmental problems of international scope, such as causes of war, problems of neutrality, and propaganda. Students are required to report on readings from current literature. (Barber.)

G. & P. 160. STATE AND LOCAL ADMINISTRATION. (3)

Prerequisite, G. & P. 1. A study of the administrative structure, procedures, and policies of state and local governments with special emphasis on the state level and on intergovernmental relationships, and with illustrations from Maryland governmental arrangements. (Dillon, Staff.)

G. & P. 161. METROPOLITAN ADMINISTRATION. (3)

Prerequisite, G. & P. 1. An examination of administrative problems relating to public services, planning, and coordination in a metropolitan environment. (Staff.)

G. & P. 171. PROBLEMS OF AMERICAN PUBLIC POLICY. (3)

Prerequisite, G. & P. 1. The background and interpretation of various factors which affect the formation and execution of American public policy. (Hathorn, Conway.)

G. & P. 174. POLITICAL PARTIES. (3)

Prerequisite, G. & P. 1. A descriptive and analytical examination of American political parties, nominations, elections, and political leadership. (Burdette, Hathorn, Conway.)

G. & P. 178. PUBLIC OPINION. (3)

Prerequisite, G. & P. 1. An examination of public opinion and its effect on political action, with emphasis on opinion formation and measurement, propaganda, and pressure groups. (Staff.)

G. & P. 181. Administrative Law. (3)

Prerequisite, G. & P. 1. A study of the discretion exercised by administrative agencies, including analysis of their functions, their powers over persons and property, their procedures, and judicial sanctions and controls. (Dillon.)

G. & P. 191. Government and Administration of the Soviet Union. (3)

Prerequisite, G. & P. 1. A study of the adoption of the communist philosophy by the Soviet Union, of its governmental structure, and of the administration of government policy in the Soviet Union. (Jacobs.)

G. & P. 192. Government and Politics of Latin America. (3)

Prerequisite, G. & P. 1. A comparative study of the governmental systems and political processes of the Latin American countries, with special emphasis on Argentina, Brazil, Chile, and Mexico. (Harrison, Barber.)

G. & P. 193. Government and Politics of Asia. (3)

Prerequisite, G. & P. 97, or G. & P. 105, or Hist. 61, or Hist. 62, or Hist. 187, or Hist. 188, or Hist. 189. A comparative study of the political systems of China, Japan, India, and other selected Asian countries. (McNelly, Hsuch.)

G. & P. 194. Government and Politics of Africa. (3)

Prerequisite, G. & P. 1. A comparative study of the governmental systems and political processes of the African countries, with special emphasis on the problems of nation-building in emergent countries. (Onyewu.)

G. & P. 195. Government and Politics of the Middle East. (3)

Prerequisite, G. & P. 1. A comparative study of the governmental systems and political processes of the Middle Eastern countries, with special emphasis on the problems of nation-building in emergent countries. (Koury.)

G. & P. 197. Comparative Political Systems. (3)

Prerequisites, G. & P. 97 and at least one other course in comparative government. A study, along functional lines, of major political institutions, such as legislatures, executives, courts, bureaucracies, public organizations, and political parties. (Staff.)

For Graduates

G. & P. 201. Seminar in International Political Organization. (3)

A study of the forms and functions of various international organizations. (Plischke, Piper.)

G. & P. 202. Seminar in International Law. (3)

Reports on selected topics assigned for individual study and reading in substantive and procedural international law. (Harrison, Piper.)

G. & P. 203. Functional Problems in International Relations. (3)

An examination of the major substantive issues in contemporary international relations, involving reports on selected topics based on individual research. (Staff.)

G. & P. 204. AREA PROBLEMS IN INTERNATIONAL RELATIONS. (3)
An examination of problems in the relations of states within a particular geographic area, such as Europe, Asia and the Far East, Africa and the Middle East, and the Western Hemisphere. Individual reporting as assigned. (Staff.)

G. & P. 205. SEMINAR IN AMERICAN POLITICAL INSTITUTIONS. (3)
Reports on topics assigned for individual study and reading in the background and development of American government. (Burdette, Hathorn, Byrd.)

G. & P. 206. SEMINAR IN AMERICAN FOREIGN RELATIONS. (3)
Reports on selected topics assigned for individual study and reading in American foreign policy and the conduct of American foreign relations. (Plischke, Barber.)

G. & P. 207. SEMINAR IN COMPARATIVE GOVERNMENTAL INSTITUTIONS. (3)
Reports on selected topics assigned for individual study and reading in governmental and political institutions in governments throughout the world. (Staff.)

G. & P. 208. SEMINAR IN THE GOVERNMENT AND POLITICS OF EMERGING NATIONS. (3)
An examination of the programs of political development in the emerging nations with special reference to the newly independent nations of Asia and Africa and the less developed countries of Latin America. Individual reporting as assigned. (Staff.)

G. & P. 209. SEMINAR IN INTERNATIONAL ADMINISTRATION. (3)
An analysis of the administrative aspects of international organizations with some attention given to program administration. (Plischke, Barber.)

G. & P. 211. SEMINAR IN FEDERAL-STATE RELATIONS. (3)
Reports on topics assigned for individual study and reading in the field of recent federal-state relations. (Dillon.)

G. & P. 213. PROBLEMS OF PUBLIC ADMINISTRATION. (3)
Reports on topics assigned for individual study and reading in the field of public administration. (Dillon.)

G. & P. 214. PROBLEMS OF PUBLIC PERSONNEL ADMINISTRATION. (3)
Reports on topics assigned for individual study and reading in the field of public personnel administration. (Staff.)

G. & P. 215. PROBLEMS OF STATE AND LOCAL GOVERNMENT. (3)
Reports on topics assigned for individual study in the field of state and local government throughout the United States. (Dillon, Staff.)

G. & P. 216. GOVERNMENT ADMINISTRATIVE PLANNING AND MANAGEMENT. (3)
Reports on topics assigned for individual study and reading in administrative planning and management in government. (Dillon.)

G. & P. 218. SEMINAR IN URBAN ADMINISTRATION. (3)
Selected topics are examined by the team research method with students responsible for planning, field investigation, and report writing. (Staff.)

G. & P. 221. SEMINAR IN PUBLIC OPINION. (3)
Reports on topics assigned for individual study and reading in the field of public opinion. (Burdette, Staff.)

G. & P. 223. SEMINAR IN LEGISLATURES AND LEGISLATION. (3)
Reports on topics assigned for individual study and reading about the composition and organization of legislatures and about the legislative process. (Burdette, Hathorn.)

G. & P. 224. SEMINAR IN POLITICAL PARTIES AND POLITICS. (3)
Reports on topics assigned for individual study and reading in the fields of political organization and action. (Burdette, Hathorn.)

G. & P. 225. MAN AND THE STATE. (3)
Prerequisite, G. & P. 142. Individual reading and reports on such recurring concepts in political theory as liberty, equality, justice, natural law and natural rights, private property, sovereignty, nationalism and the organic state. (Anderson, Byrd, Claude.)

G. & P. 226. SCOPE AND METHOD OF POLITICAL SCIENCE. (3)
Required of all Ph.D. candidates. A seminar in the methodologies of political science, and their respective applications to different research fields. Interdisciplinary approaches and bibliographical techniques are also reviewed. (Staff.)

G. & P. 227. ANALYTICAL SYSTEMS AND THEORY CONSTRUCTION. (3)
Prerequisite, G. & P. 226. Examination of the general theoretical tools available to political scientists and of the problems of theory building. Attention is given to communications theory, decision-making, game theory and other mathematical concepts, personality theory, role theory, structural-functional analysis, and current behavioral approaches. (Staff.)

G. & P. 231. SEMINAR IN PUBLIC LAW. (3)
Reports on topics assigned for individual study and reading in the fields of constitutional and administrative law. (Hathorn, Byrd.)

G. & P. 261. PROBLEMS IN AMERICAN GOVERNMENT AND POLITICS. (3)
An examination of contemporary problems in various fields of government and politics in the United States, with reports on topics assigned for individual study. (Staff.)

G. & P. 399. THESIS RESEARCH. (Arranged).
(Staff.)

HISTORY

Professors: Shannon, Bauer, Cole, Gordon, Jashemski, Koch, Merrill, Prange, and Sparks.

Visiting Professor: Main (1965-1966).

Associate Professors: Callcott, Conkin, and Rivlin.

Assistant Professors: Breslow, Farrell, Folsom, Giffin, Greenberg, Robertson, Williams, and Yaney.

MASTER OF ARTS

A. Course Requirements

1. Course requirements are those set forth under Academic Information in this catalog with the exception of No. 2 and No. 3 below.
2. The course, H. 200—*Historiography,* is required.
3. Fifteen hours of the total required for the Master of Arts degree must be in history, of which at least 9 hours shall be in the field of concentration.

B. Thesis

1. A thesis is required of all candidates for the Master of Arts degree in history.
2. The Department of History expects that the thesis, required of all candidates for the master's degree, shall display a capacity for directed research in a variety of historical sources, the ability to interpret factual detail, and shall constitute a properly documented report of the completed research.

C. Examinations

1. Candidates for the Master of Arts degree must pass a 4 to 6 hour written examination. The primary purpose of this examination is to determine the student's mastery of his major field. The examination will require factual and interpretive material as well as bibliography and historiography.
2. The oral examination will be confined to the thesis and the field in which it lies.

DOCTOR OF PHILOSOPHY

A. Course Requirements

1. Course requirements are those set forth under Academic Information in this catalog, with the exception of 2 and 3 below.
2. The course, H. 200—*Historiography*, is required.

3. In consultation with his adviser, a candidate must select four general fields to present for examination.

4. Fields:

Greek History	Russian History
Roman History	Middle Eastern History
Medieval History	East Asian History
European History 1500-1789	Latin American History
European History 1789-Present	U.S. History to 1865
English History	U.S. History Since 1865
British Empire	Minor Outside Department

B. Examinations

1. The Qualifying Examination is normally taken after the student has completed one year's work beyond the M.A. Separate written examinations of 4 to 6 hours each will be given on two selected fields on successive days. One language examination must be passed before the qualifying examination can be administered.

2. The Comprehensive Examination is taken at the completion of the student's course work. The comprehensive examination covers the two remaining fields and will consist of written examinations of 4 to 6 hours in each field and an oral examination of approximately two hours duration. The second language examination must be passed before the comprehensive examination can be administered. The satisfactory completion of the comprehensive examination shall for departmental purposes constitute admission to candidacy for which the student must make formal application within one month.

3. The Final Examination is conducted by a committee appointed by the Dean of the Graduate School. This examination, of approximately two hours duration, covers the research of the candidate as embodied in his thesis and his attainments in the fields of his major and minor subjects.

C. The following languages are approved for the Ph.D. requirement:

French, German, Russian, Spanish, Arabic, Turkish, Persian, Hebrew, Chinese, and Japanese. One of the languages must be either French or German. No two languages offered may be in the same language family.

D. The Ph.D. Dissertation

The Department of History expects that the dissertation, required of all candidates for the doctorate, shall display a capacity for independent research in primary and secondary sources. The resulting synthesis must constitute a contribution to historical knowledge and ought to reveal the qualities of insight and sound judgment in the handling of historical materials.

For Graduates and Advanced Undergraduates

AMERICAN HISTORY

H. 101. American Colonial History. (3)

The settlement and development of colonial America to the middle of the eighteenth century. (Land.)

H. 102. The American Revolution. (3)

The background and course of the American Revolution through the formation of the Constitution. (Koch.)

H. 103. The Formative Period in America, 1789-1824. (3)

The evolution of the Federal government, the origins of political parties, problems of foreign relations in an era of international conflict, beginnings of the industrial revolution in America, and the birth of sectionalism. (Koch.)

H. 105. Social and Economic Hsitory of the United States to 1865. (3)

A synthesis of American life from Independence through the Civil War. (Staff.)

H. 106. Social and Economic History of the United States Since the Civil War. (3)

The development of American life and institutions, with emphasis upon the period since 1876. (Staff.)

H. 114. The Middle Period of American History, 1824-1860. (3)

An examination of the political history of the United States from Jackson to Lincoln with particular emphasis on the factors producing Jacksonian democracy, Manifest Destiny, the Whig Party, the anti-slavery movement, the Republican Party, and secession. (Sparks.)

H. 115. The Old South. (3)

Prerequisite, H. 21, 22, or the equivalent. A study of the institutional and cultural life of the ante-bellum South with particular reference to the background of the Civil War. (Calcott.)

H. 116. The Civil War. (3)

Military aspects; problems of the Confederacy; political, social, and economic effects of the war upon American society. (Sparks.)

H. 118, 119. Recent American History. (3,3)

Party politics, domestic issues, foreign relations of the United States since 1890. First semester, to 1929. Second semester, since 1929. (Merrill, Glad.)

H. 121. History of the American Frontier. (3)

The Trans-Allegheny West. The westward movement into the Mississippi Valley. (Staff.)

H. 124. Reconstruction and the New Nation, 1865-1896. (3)

Prerequisite, H. 21, 22, or the equivalent. Problems of construction in both South and North. Emergence of big business and industrial combinations. Problems of the farmer and laborer. (Staff.)

H. 127, 128. Diplomatic History of the United States. (3,3)
A historical study of the diplomatic negotiations and foreign relations of the United States. First semester from the Revolution to the Civil War. Second semester, from the Civil War to the present. (Cole.)

H. 129. The United States and World Affairs. (3)
A consideration of the changed position of the United States with reference to the rest of the world since 1917. (Cole.)

H. 133, 134. The History of Ideas in America. (3,3)
A history of basic beliefs about religion, man, nature, and society. Consent of the instructor is required for H. 134. (Conkin.)

H. 135, 136. Constitutional History of the United States. (3,3)
A study of the historical forces resulting in the formation of the Constitution, and development of American constitutionalism in theory and practice thereafter. (Staff.)

H. 141, 142. History of Maryland. (3,3)
First semester, a survey of the political, social and economic history of colonial Maryland. Second semester, Maryland's historical development and role as a state in the American Union. (Staff.)

H. 147. History of Mexico and the Caribbean. (3)
The history of Mexico and the Caribbean with special emphasis upon the independence period and upon relations between ourselves and our nearest Latin American neighbors. (Staff.)

H. 148. History of Canada. (3)
Prerequisites, H. 21, 42, or H. 53, 54. A history of Canada, with special emphasis on the nineteenth century and upon Canadian relations with Great Britain and the United States. (Gordon.)

H. 149. History of Brazil. (3)
The history of Brazil with emphasis on the national period. (Griffin.)

H. 150. History of Argentina and the Andean Republics. (3)
The history of the nationalist period of selected South American countries. (Staff.)

EUROPEAN HISTORY

H. 151. History of the Ancient Orient and Greece. (3)
A survey of the ancient civilizations of Egypt, the Near East, and Greece, with particular attention to their institutions, life, and culture. (Jashemski.)

H. 153. History of Rome. (3)
A study of Roman civilization from the earliest beginnings through the Republic and down to the last centuries of the Empire. (Jashemski.)

H. 155, 156. History of Medieval Europe. (3,3)
A study of medieval government, society, and thought from the collapse of classical civilization to the Renaissance. (Robertson.)

H. 157. The Age of Absolutism, 1648-1748. (3)

Europe in the Age of Louis XIV and the Enlightened Despots. (Staff.)

H. 158. The Old Regime and the French Revolution, 1748-1815. (3)

Europe in the era of the French Revolution. (Staff.)

H. 159, 160. History of European Ideas. (3,3)

Prerequisites, H. 41, 42 or H. 53, 54, or the equivalent. Beginning with a review of the basic Western intellectual traditions as a heritage from the Ancient World, the course will present selected important currents of thought from the scientific revolution of the sixteenth and seventeenth century down to the twentieth century. First semester, through the eighteenth century. Second semester, nineteenth and twentieth centuries. (Staff.)

H. 161. The Renaissance and Reformation. (3)

Prerequisite, H. 41, 42, or 53, or the permission of the instructor. The culture of the Renaissance, the Protestant revolt and Catholic reaction through the Thirty Years' War. (Breslow.)

H. 163, 164. History of the British Empire. (3,3)

Presequisites, H. 41, 42, or H. 53, 54. First semester, the development of England's Mercantilist Empire and its fall in the war for American Independence (1783). Second semester, the rise of the Second British Empire and the solution of the problem of responsible self-government (1783-1867), the evolution of the British Empire into a Commonwealth of Nations, and the development and problems of the dependent Empire. (Gordon.)

H. 165. Constitutional History of Great Britain. (3)

A survey of constitutional development in England with emphasis on the real property aspects of feudalism, the growth of the common law, the development of Parliament, and the expansion of liberties of the individual. (Gordon.)

H. 166. Tudor-Stuart England. (3)

An examination of the political, religious and social forces in English life from 1485-1714 with special emphasis on Tudor government, the English Reformation, the Elizabethan era, Puritanism, and the English revolution. (Breslow.)

H. 167, 168. History of Russia. (3,3)

A history of Russia from earliest times to 1917. (Yaney.)

H. 169, 170. Europe in the Nineteenth Century, 1815-1919. (3,3)

Prerequisites, H. 41, 42, or H. 53, 54. A study of the political, economic, social and cultural development of Europe from the Congress of Vienna to the First World War. (Bauer.)

H. 171, 172. Europe in the World Setting of the Twentieth Century. (3,3)

Prerequisites, H. 41, 42, or H. 53, 54. A study of political, economic, and cultural developments in twentieth century Europe with special emphasis on the factors involved in the two World Wars and their global impacts and significance. (Prange.)

H. 173. The Soviet Union. (3)

A history of the Bolshevik Revolution and the founding of the Soviet Union; the economic policy and foreign policy of the U.S.S.R. to the present.

(Yaney.)

H. 175. Modern France. (3)

A survey of French history from 1815 to the present. The emphasis is upon such topics as the population problem, the economic and social structure of French society, and the changing political and cultural values of this society in response to recurrent crises through the nineteenth and twentieth centuries. (Greenberg.)

ASIAN HISTORY

H. 181, 182. The Middle East. (3,3)

Prerequisites, six hours from the following groups of courses: H. 41, 42; H. 51, 52; or H. 53, 54. A survey of the historical and institutional developments of the nations of this vital area. The Islamic Empires and their cultures; impact of the west; breakup of the Ottoman Empire and rise of nationalism; present day problems. (Rivlin.)

H. 183. The Contemporary Middle East. (3)

H. 181 or 182 recommended though not required. The development of middle eastern institutions in the nineteenth and twentieth centuries with reference to the emergence of contemporary states and their place in world affairs.

(Rivlin.)

H. 187, 188. History of China. (3,3)

A history of China from earliest times to the present. The emphasis on the development of Chinese institutions that have molded the life of the nation and its people. (Folsom.)

H. 189. History of Japan. (3)

A history of Japan from earliest to modern times. Emphasis is placed on the evolution of institutions and thought. (Folsom.)

For Graduates

H. 300. Historiography: Techniques of Historical Research and Writing. (3)

(Staff.)

H. 301. Readings in Colonial American History. (3)

(Land.)

H. 302. Seminar in Colonial American History. (3)

(Land.)

H. 303. Readings in the American Revolution and the Formative Period. (3)

(Koch.)

H. 304. Seminar in the American Revolution and the Formative Period. (3)
(Koch.)

H. 305. Readings in American Social and Economic History. (3)
(Staff.)

H. 306. Seminar in American Social and Economic History. (3)
(Staff.)

H. 313. Readings in Southern History. (3)
(Callcott.)

H. 314. Seminar in Southern History. (3)
(Callcott.)

H. 315. Readings in the Middle Period and Civil War. (3)
(Sparks.)

H. 316. Seminar in the Middle Period and Civil War. (3)
(Sparks.)

H. 317. Readings in Reconstruction and the New Nation. (3)
(Staff.)

H. 318. Seminar in Reconstruction and the New Nation. (3)
(Staff.)

H. 323. Readings in Recent American History. (3)
(Shannon, Merrill.)

H. 324. Seminar in Recent American History. (3)
(Shannon, Merrill.)

H. 327. Readings in the History of American Foreign Policy. (3)
(Cole.)

H. 328. Seminar in the History of American Foreign Policy. (3)
(Cole.)

H. 333. Readings in American Intellectual History. (3)
(Conkin.)

H. 334. Seminar in American Intellectual History. (3)
(Conkin.)

H. 336. Seminar in American Constitutional and Political History. (3)
(Staff.)

H. 342. Seminar in the History of Maryland. (3)
(Staff.)

H. 345. Readings in Latin American History. (3)
(Giffin.)

H. 346. Seminar in Latin American History. (3)
(Giffin.)

H. 351. Seminar in Greek History. (3)
(Jashemski.)

H. 353. Seminar in Roman History. (3)
(Jashemski.)

H. 355. Readings in Medieval History. (3)
(Robertson.)

H. 356. Seminar in Medieval History. (3)
(Robertson.)

H. 359. Readings in Modern European Intellectual History. (3)
(Staff.)

H. 360. Seminar in Modern European Intellectual History. (3)
(Staff.)

H. 361. Readings in the History of the Renaissance and Reformation. (3)
(Breslow.)

H. 363. Readings in the History of Great Britain and the British Empire-Commonwealth. (3)
(Gordon.)

H. 364. Seminar in the History of Great Britain and the British Empire-Commonwealth. (3)
(Gordon.)

H. 366. Seminar in Tudor and Stuart England. (3)
(Breslow.)

H. 368. Seminar in Russian History. (3)
(Yaney.)

H. 369. Readings in Nineteenth Century Europe. (3)
(Bauer.)

H. 370. Seminar in Nineteenth Century Europe. (3)
(Bauer.)

H. 371. Seminar in the History of World War I. (3)
(Prange.)

H. 372. Seminar in the History of World War II. (3)
(Prange.)

H. 381. Readings in Middle Eastern History. (3)
(Rivlin.)

H. 382. Seminar in Middle Eastern History. (3)
(Rivlin.)

H. 387. Readings in Chinese History. (3)
(Folsom.)

H. 388. Seminar in Chinese History. (3)
(Folsom.)

H. 390. The Teaching of History in Institutions of Higher Learning. (1)
(Staff.)

H. 399. Thesis Research. (1-6)
(Staff.)

HOME ECONOMICS

Professors: Chapman and Mitchell.

Associate Professors: Brown, Reiber, Shearer, and Wilson.

Assistant Professors: Eheart and Wilbur.

Lecturer: Britton.

The College offers programs of study leading to the degree of Master of Science in the fields of food and nutrition, institution administration, general home economics, and textiles and clothing.

A candidate for an advanced degree with a major or minor in home economics is expected to have an undergraduate major in home economics or in closely allied fields. The graduate study program will supplement the student's previous training and experience to achieve a well-rounded knowledge of the subject, with due consideration given to his purpose in undertaking graduate study. Graduate students may prepare for some specialized phases of home economics, including food, nutrition, textiles and clothing, and home economics education. (See Department of Education.) A student whose preparation is deficient in any area may meet prerequisites during a period of study as a special student or as a provisional candidate. Interdepartmental programs and offerings in the several areas of home economics to give breadth of contact with the field of home economics are available.

FOOD AND NUTRITION

Students with a major or minor in the field of food and nutrition may select from a variety of courses, seminars, and experiences in independent

study. Each student plans his program in consultation with his major adviser, after consideration of his background and purpose in graduate study.

A master's degree candidate wishing to major in this field is expected to have had training equivalent to that of an undergraduate major in the Department of Food Nutrition and Institution Management (basic courses in food and nutrition, organic and biochemistry, microbiology, and physiology).

GENERAL HOME ECONOMICS

This program is oriented toward home economists whose work is centered in home, school and community services, and to home economists returning to employment after a period of absence. It is primarily designed to increase competence in more than one area within the field of home economics. The program utilizes many courses in the University as well as the College to permit a well-integrated study.

TEXTILES AND CLOTHING

For students who wish to major or minor in textiles and clothing a variety of offerings is available as to course work and opportunities for independent study. Candidates for a Master of Science degree in the field of textiles and clothing are expected to acquire a general knowledge of all phases of the field and an understanding of research methods in it, and to concentrate in one of the various areas of textiles and clothing.

FOOD, NUTRITION AND INSTITUTION ADMINISTRATION

For Graduates and Advanced Undergraduates

FOOD

F. & N. 130. Special Problems in Food and/or Nutrition. (1-3)

First and second semesters. Prerequisites, F. & N. 5, Food 10, or consent of instructor. Problem may be in any one of several areas of food and nutrition and will carry the name of the basic area; e. g., child nutrition, adolescent nutrition. (Brown.)

Food 150. Food Economics and Meal Management. (3)

First and second semesters. Two lectures and one two-hour laboratory period a week. Consent of department. Laboratory fee, $10.00. Distribution and marketing of the food supply; food costs; legal measures for consumer protection; retail selection of food commodities in relation to levels of spending; management of family meals through organization of equipment and appointments; time, energy, and money management for effective family living. (Staff.)

Food. 152. Advanced Food Science. (3)

First semester. Three lectures per week. Prerequisites, Chem. 31, 33 and Food 10, or equivalent. Physical and chemical properties of food as related to consumer use in the home and institution.

FOOD 153. EXPERIMENTAL FOOD SCIENCE. (3)

Second semester. One lecture and two laboratories per week. Laboratory fee, $10.00; Prerequisite. Food 152 or equivalent, Individual and group laboratory experimentation as an introduction to methods of food research.

For Graduates

FOOD

FOOD 200. ADVANCED EXPERIMENTAL FOOD. (3-5)

Second semester. Two lectures and three laboratory periods a week. Laboratory fee, $10.00. Selected readings of literature in experimental foods. Development of individual problem. (Eheart.)

FOOD 204. RECENT TRENDS IN FOOD. (2-3)

First semester. Recent trends in the preparation, processing, and marketing of foods. (Brown.)

FOOD 210. READINGS IN FOOD. (3)

First or second semester. Prerequisites, Food 152, 153. A critical survey of the literature of recent developments in food research. (Eheart.)

FOOD 220. SEMINAR. (1-2)

First and second semesters. Reports and discussions of current research in foods. (Eheart.)

FOOD 399. RESEARCH. (1-6)

First and second semesters. Credit in proportion to work done and results accomplished. Investigation in some phases of food which may form the basis for a thesis. (Eheart.)

INSTITUTION ADMINISTRATION

I. M. 150. INSTITUTION ORGANIZATION AND MANAGEMENT. (3)

First semester. Prerequisite, F. & N. 5. Planning of functional kitchens for institutions and commercial food services. Equipment selection and maintenance, layout, field trips and observations in a variety of situations. (Brown.)

I. M. 151. INSTITUTION FOOD PURCHASING AND COST CONTROL. (3)

First and second semesters. Prerequisite, Food 10; Nutr. 20 or equivalent. Selection of food, methods and units of purchase in large quantities. Budgets, food cost accounting and control. Field trips.

I. M. 152. INSTITUTION FOODS. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Food 10; Nutr. 20 or 121; or consent of instructor. Laboratory fee, $10.00. Application of basic principles and procedures of food preparation to quantity food preparation. Standardizing recipes; menu planning for various types of food services; determination of food costs. (Brown.)

I. M. 153. Food Service Organization and Management. (2)

Second semester. Prerequisite. consent of instructor. Application of principles of scientific management to the organization of food services. Efficient personnel management with emphasis on training and supervision of employees. (Brown.)

I. M. 154. School Food Service. (3)

First semester. Two lectures and one morning a week for field experience in a school food service. Prerequisites, Food 10 and Nutr. 20 or 121, or consent of instructor. Not open to Institution Administration majors. Study of organization, management. menu planning. food purchasing and preparation and cost control for serving the noon meal in schools and child care centers. (Brown.)

I. M. S166. Nutrition and Meal Planning. (2)

Summer only. Special application to group food services: school lunches, restaurants, and hospitals. (Staff.)

I. M. S168. Cost Accounting for School Food Service. (2)

Summer Session. Food cost accounting systems for school lunch programs; programs and procedures of accumulating, recording, and interpreting data for cost control. (Staff.)

I. M. S169. Food Purchasing for School Food Service. (3)

Summer session. Purchasing procedures; grading, processing and packing of food: selection of food, specifications, and marketing regulations. (Staff.)

For Graduates

I. M. 200. Food Service Administration and Supervision. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, I.M. 152 and 154 or equivalent. Supervision and administrative policies; personnel management with emphasis on human relations, and philosophy underlying management practices.

NUTRITION

Nutr. 121. Science of Nutrition. (3)

First semester. Prerequisites, Chem. 11, 13 or 1, 3, or consent of department. Two lectures and one two-hour laboratory period a week. An understanding of the chemical and physiological utilization of nutrients present in the various food as related to individual human nutritional status, with studies of applied nutrition. Laboratory fee, $3.00. (Staff.)

Nutr. 123. Nutrition for Health Services. (3)

First and second semesters. Prerequisite. Nutr. 20. Chem. 11, 13 or 1, 3 or equivalent. Laboratory fee, $3.00. A study of nutritional status and the effect of food habits and food consumption on family health. Nutritional requirements for individuals in different stages of development. Techniques and procedures for the application of nutrition knowledge with consideration of various economic levels and social backgrounds. For graduate nurses, dietitians, health teachers, and social workers. (Staff.)

Nutr. 124. Advanced Nutrition. (3)

First semester. Prerequisites, Consent of department; Zool. 1; Biochem. 81, 82 or concurrent. Laboratory fee, $10.00. Two lectures and one two-hour laboratory. The progress of nutrition as found in the results of current research, with emphasis on interpretation and application.

Nutr. 125. Therapeutic Nutrition. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, Nutr. 121, 124. Laboratory fee, $3.00. Modifications of the normal adequate diet to meet human nutritional needs in pathological conditions. (McKinley.)

For Graduates

Nutr. 204. Recent Advances in Nutrition. (2-3)

First and second semester. Factors that affect the nutritive value of food during production, cookery processes, holding practices, processing, packaging, and storage. (Staff.)

Nutr. 208. Recent Progress in Human Nutrition. (3)

Second semester. Recent developments in the science of nutrition with emphasis on the interpretation of these findings for application in health and disease. Aids for the dietitian in creating a better understanding of nutrition among patients, students of graduate status and personnel, such as those in the dental and medical professions. (Staff.)

Nutr. 210. Readings in Nutrition. (3).

First and second semesters. Reports and discussions of significant nutritional research and investigation . (Staff.)

Nutr. 211. Problems in Nutrition. (3-5)

Second semester. Experience in a phase of nutrition research which is of interest to the student. Use of experimental animals, human studies or a compilation and extensive and critical study of research methods, techniques or data of specific projects.

Nutr. 212. Nutrition for Community Services. (3)

First semester. Application of the principles of nutrition to various community problems of specific groups of the public. Students may select specific problems for independent study. (Staff.)

Nutr. 220. Seminar. (1)

First and second semesters. Reports and discussion of current research in nutrition. (Staff.)

Nutr. 399. Research. (6)

First and second semesters. Credit in proportion to work done and results accomplished. Investigation in some phase of nutrition which may form the basis of a thesis.

GENERAL HOME ECONOMICS

For Graduates and Advanced Undergraduates

H. E. 170. Communication Skills and Techniques in Home Economics. (3)

First and second semesters. Laboratory fee, $10.00. Principles and techniques for professional demonstration and presentation of home economics and its related areas with selected experiences in television, radio, creative writing, and photography. (Staff.)

H. E. 180. Professional Seminar. (2)

First and second semester. Clarification of perceptions of one's job and the situation in which one operates; attainment of professional breadth and depth; establishment of reasonable levels of aspiration—recognized to be requisites for a successful career in home economics and related areas. (For seniors in College of Home Economics.) (Lemmon.)

H. E. 190. Special Problems in Home Economics. (1-3)

First and second semesters. Consent of instructor. Laboratory fee, $3.00 a semester hour. Problem may be in any area of home economics and will carry the name of the subject matter of the problem. a. Applied (Art) Design; b. Clothing; c. General Home Economics; d. Family Life; e. Food and Institutional Food; f. Management; g. Nutrition; h. Textiles. (Staff.)

For Graduates

H. E. 201. Methods of Research in Home Economics. (3)

First and second semesters. Prerequisite, Statistics or Tests and Measurements. Application of scientific methods to problems in the field of home economics with emphasis on needed research of an inter-disciplinary nature. (Staff.)

H. E. 202. Integrative Aspects of Home Economics. (2)

First and second semesters. Prerequisite, consent of instructor. Scope and focus of total professional field with emphasis on purposes and functions as related to family and other group living. Impact of the changing social, economic, technological and educational situations upon home economics. (Staff.)

H. E. 290. Special Topics. (1-6)

First and second semesters. Summer session. Concentrated study in areas of home economics, such as: consumer problems; housing, interior design and home furnishings; institution administration and food service: a. Applied (Art) Design; b. Clothing; c. General Home Economics; d. Family Life; e. Food and Institutional Food; f. Management; g. Nutrition; h. Textiles. (Staff.)

H. E. 399. Thesis Research. (1-6)

First and second semesters. Summer session. Credit according to work accomplished.

FAMILY LIFE AND MANAGEMENT

For Advanced Undergraduates and Graduates

F. L. 130. Home Management and Family Life. (3)
First semester. Prerequisites, Psych. 1; H. M. 50; H. E. 5. Study of factors influencing establishment and maintenance of satisfying interpersonal relations throughout the family life cycle as affected by management in the home. (Reiber.)

F. L. 132. The Child in the Family. (3)
Second semester. Three lectures. Prerequisites, Psych. 1; H. E. 5 or equivalent. Study of the child from prenatal stage through adolescence, with emphasis on responsibility for guidance in the home. Biological and psychological needs as they affect the child's relationship with his family and peers. (Reiber.)

F. L. 135. Directed Experiences with Children and Families. (3)
First and second semesters. Laboratory fee, $3.00. Prerequisites, Psych. 1 and consent of department. Observation and study of selected home situations placing emphasis on contemporary family living. This course is designed especially for students who wish an understanding of children of various ages in relation to the family and the quality of living achieved in a variety of life situations. (Limited to majors in the College of Home Economics.) (Kincaid.)

H. M. 140. Fundamentals of Housing. (3)
Second semester. Two lectures and one two-hour laboratory a week. Prerequisite, H. M. 50. Laboratory fee, $3.00. Sociological, psychological and economic aspects of housing. Relationship of the house and the family living within. (Staff.)

H. M. 160. Scientific Management in the Home. (3)
First and second semesters. Two lectures and one two-hour laboratory period a week. Prerequisite, H. M. 50 or equivalent. Laboratory fee, $3.00. The Philosophy and application of principles of scientific management in the home through the use of resources; management of time, energy, and money; work simplification. (Staff.)

H. M. 161. Resident Experience in Home Management. (3)
First and second semesters. Prerequisites, H. M. 50, 160; Food 150; or equivalent. Residence from five to nine weeks in the home management center. Experience in planning, coordinating, and participating in the activities of a household, composed of a faculty member, a group of students, and possibly an infant on a part-time basis. Laboratory fee, $10.00.

H. M. 162. Personal and Family Finance. (2)
First semester. Prerequisite, H. M. 50. Study of factors influencing use of money; how families attempt to achieve financial security; interrelationship of money and other resources; types of credit. Emphasis on management of the family's money. (Britton.)

H. M. 165. Home Management Practicum. (3)

First and second semesters. Prerequisites, H. M. 50, 160; Food 150; or equivalent; consent of department. Laboratory fee $3.00. Home management experience under supervision in a variety of situations. Designed especially for students who are managing their own homes. (Orvedal.)

HOUSING AND APPLIED (ART) DESIGN

For Graduates and Advanced Undergraduates

A. D. 100, 101. Mural Design. (2, 2)

First semester, alternate years. Three laboratory periods a week. Prerequisites, A. D. 1, 21. Fee, $3.00. Group and individual expression serving two types of objectives: temporary murals for the public schools developed from classroom study and rendered in colored chalk on wrapping paper; murals for permanent architectural decoration considering propriety to setting and rendered in oil paint, gouache, fresco, or mosaic. Brief study of civilization's use of murals. Trips to nearby murals having social significance. (Curtiss.)

H.A.D. 110. Exterior-Interior Housing Design. (3)

First and second semesters. Two lectures and one two-hour laboratory period a week. Laboratory fee, $3.00. Prerequisite, H. A. D. 41. An analysis of the works of contemporary architects and an overview of the field of architecture, relating the elements and principles to interiors. (Stewart.)

A. D. 120, 121. Costume Illustration. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 2, 20, 21. Fee, $3.00. Fashion rendering emphasizing clothing structure, representation of materials and development of individual rendering technique. Development of techniques employing transparent water color, India ink, Craftint, Zipatone and Burgess process. Study of styles of contemporary fashion illustrators. (Beckwith.)

A. D. 124, 125. Individual Problems in Costume. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 2, 20, 21, 120, 121. Fee, $3.00. Advanced problems in fashion illustration or costume design for students who are capable of independent work. Program developed in consultation with the instructor. (Beckwith.)

A. D. 132. Advertising Layout. (2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 20, 30, 40. Fee, $3.00. Designing of rough to finished layouts for advertisements for newspapers, magazines, packaging, brochures and other forms of direct advertising. Included is the study of typography and illustration and their relationship to reproduction. Experience in use of the airbrush. Field trip.

A. D. 134, 135. Individual Problems in Advertising. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 20, 30, 40, 132. Fee, $3.00. Advanced problems in advertising layout. Opportunity to build skills in one area or more of advertising design. Readings. Field trip.

A. D. 136. DISPLAY. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, A.D. 1, 4, 30. Fee, $3.00. Practice in effective merchandise display in cooperation with retail establishments. Study of other aspects of display through field trips, discussion and research. (Nisonger.)

A. D. 138. ADVANCED PHOTOGRAPHY. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, 38, 39. Fee, $3.00. Advanced experimental effects emphasizing design in photography. Each student must have his own camera. (Davis.)

H.A.D. 142, 143. ADVANCED INTERIOR DESIGN. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 2, 40, 41. Fee, $3.00. Designs of rooms drawn in perspective and isometrics and rendered in water color. Coordination with fabrics, floor and wall finishes. Study of budgets, costs, and manufacturing techniques. Field trips.
(Odland, Stewart.)

H.A.D. 144, 145. INDIVIDUAL PROBLEMS IN INTERIOR DESIGN. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, A. D. 1, 2, 40, 41, 142, 143. Fee, $3.00. Advanced problems in interior design for students who are capable of independent work. Students assume the role of interior decorator serving the needs of theoretical clients. Field trips.
(Odland, Stewart.)

CRAFTS

CR. 102. CREATIVE CRAFTS. (2-4)

Summer session. Daily laboratory periods. Prerequisites, A. D. 1 and permission of the instructor. Fee, $3.00. Interests of the persons enrolled will determine the crafts pursued. Suggested: block printing, wood burning, crayon decoration, paper sculpture, clay modeling, metalry, weaving. Excellent for teachers, directors of recreation centers, and persons who desire an introduction to recreational crafts. (Roper.)

CR. 120, 121. ADVANCED CERAMICS. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 20, 21. Fee, $3.00. Advanced techniques in clay sculpture and in building pottery on the potter's wheel. Study of glaze composition and calculation. Experimentation with several clay bodies. (Roper.)

CR. 124, 125. INDIVIDUAL PROBLEMS IN CERAMICS. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 20, 21, 120, 121. Fee, $3.00. Individual problems in clay sculpture and pottery making. Use of gas kiln fired in the medium cone range and experimental research in glazes and original textural effects. (Roper.)

CR. 130, 131. ADVANCED METALRY. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 30, 31. Fee, $3.00. Advanced applications of basic techniques in metal working and jewelry making. Introduction of ring making, stone setting, and metal casting. (Staff.)

Cr. 134, 135. Individual Problems in Metalry. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 30, 31, 130, 131. Fee, $3.00. Advanced problems in metalry and jewelry making. Supervised laboratory for students capable of independent work and research. (Staff.)

Cr. 140, 141. Advanced Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 40, 41. Fee, $3.00. Advanced weaving on four and eight harness looms stressing creative weaves in relation to functional use. (Staff.)

Cr. 144, 145. Individual Problems in Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, A. D. 1, Cr. 40, 41, 141. Fee, $3.00. Advanced problems in creative weaving. Supervised laboratory for students capable of independent work and research. (Staff.)

TEXTILES AND CLOTHING

For Graduates and Advanced Undergraduates

T. & C. 101. Fashion Promotion and Coordination. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, T. & C. 126; Speech 115 or 117. Laboratory fee, $3.00. Analysis of fashion media; industry publications, magazines, newspapers, radio, TV; merchandise displays and fashion shows. Role of the stylist. (Staff.)

T. & C. 110. Field Experience in Textiles and Clothing. (3)

First semester or summer school. Prerequisite, senior standing in department. Supervised and coordinated training-work program in cooperation with agencies and organizations. (Mitchell.)

T. & C. 126. Fundamentals of Fashion. (3)

Second semester. Prerequisite, Clo. 120. Laboratory fee, $3.00. Fashion history; current fashions, how to interpret and evaluate them; fashion show techniques; fashion promotion. The course includes oral and written reports, group projects, panel discussions and field trips. (Wilbur.)

T. & C. 128. Fundamentals of Home Furnishings. (3)

First and second semesters. Three laboratory periods a week. Prerequisites, T. & C. 5, Clo. 10, or consent of instructor. Laboratory fee, $3.00. Selection of fabrics for home and institutional furnishings; care and repair of such furnishings; custom construction of slip covers, draperies, bedspreads; refinishing and upholstering furniture. (Wilbur.)

For Graduates and Advanced Undergraduates

Tex. 102. Textile Testing. (3)

Second semester. Three laboratory periods a week. Prerequisite, Tex. 150. Laboratory fee, $3.00. The theory of textile methods, the repeated use of physical and chemical testing, the interpretation of the data, and the presentation of the findings. (Young.)

TEX. 150. ADVANCED TEXTILES. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Tex. 55. Laboratory fee, $3.00. An intensive study of textiles from the fiber to the finished fabric, from the producer to the consumer. Analysis of fabric construction and serviceability features. (Staff.)

TEX. 153. INTERNATIONAL TEXTILES. (2)

First semester. Two lectures a week. Laboratory fee, $3.00. Prerequisite. T. & C. 5 or consent of instructor. Study of historic and contemporary fibers and laces with analysis of designs and techniques of decorating fabrics; relationship of textiles to the esthetic and developmental cultures of society. (Wilbur.)

CLOTHING

CLO. 100. FAMILY CLOTHING. (3)

First semester in alternate years. One lecture and two laboratory periods a week. Prerequisites, T. & C. 5; Clo. 10, 11; or equivalent. Laboratory fee, $3.00. Clothing the family; analysis of needs of family members in various stages of life cycle; individual and family budgets; problems in selection and/or construction of wardrobe items. (Staff.)

CLO. 120. DRAPING. (3)

First semester. Two laboratory periods a week. Prerequisite, Clo. 10. Laboratory fee, $3.00. Demonstrations and practice in creating costumes in fabrics and on individual dress forms; modeling of garments for class criticism. (Staff.)

CLO. 122. TAILORING. (2)

First and second semesters. Two laboratory periods a week. Prerequisite. Clo. 21. Laboratory fee, $3.00. Construction of tailored garments requiring professional skill. (Mitchell.)

CLO. 127. APPAREL DESIGN. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Clo. 120. Laboratory fee, $3.00. The art of costuming; trade and custom methods of clothing design and construction; advanced work in draping, pattern design and/or tailoring, with study of the interrelationship of these techniques. (Staff.)

For Graduates

TEX. 200. SPECIAL STUDIES IN TEXTILES. (2-4)

First or second semester. Summer session. Laboratory fee, $3.00. Advanced inquiry into uses, care, types and/or performance of textile materials. either contemporary or historic depending on interest of students; compilation of data through testing, surveys, museum visits and/or field trips; writing of technical reports. (Staff.)

CLO. 220. SPECIAL STUDIES IN CLOTHING. (2-4)

First or second semester. Laboratory fee, $3.00. Special areas of clothing are selected according to interest of student; consumer, design, functional aspects. and/or evaluation and analysis studies are made of those areas. Reports may be written, oral, or by group presentation. (Mitchell.)

T. & C. 230. SEMINAR. (1)

First and second semesters. Laboratory fee, $3.00. The breadth and limit of the field of textiles and clothing are investigated; annotated bibliography is developed; one oral report is presented. (Mitchell.)

T. & C. 232. ECONOMICS OF TEXTILES AND CLOTHING. (3)

Second semester. Laboratory fee, $3.00. Study of interrelationship of developments in production, distribution and consumption of textiles and clothing affecting consumers and the market. Analysis of consumption trends as related to patterns of family living and population changes. (Mitchell.)

T. & C. 233. SYNTHESES OF BEHAVIORAL SCIENCE CONCEPTS IN TEXTILES AND CLOTHING. (3)

First and second semesters. Prerequisites, Psych. 21 and/or consent of department. Analysis and interpretation of interdisciplinary research methods and findings with reference to behavioral aspects of textiles and clothing. Consideration given to measurement and relation of clothing interest and behavior to attitudes, values, roles, and social status groupings.

T. & C. 399. RESEARCH. (1-6)

First and second semesters. Laboratory fee. $3.00. A research problem is selected by the student; thesis for partial fulfillment of the Master of Science degree is written.

HORTICULTURE

Professors: STARK, HAUT, KRAMER, LINK, REYNOLDS, SCOTT, SHANKS AND THOMPSON.

Associate Professors: SNYDER AND WILEY.

The Department of Horticulture offers programs leading to the degrees of Master of Science and Doctor of Philosophy. Programs in *floriculture and ornamental horticulture, olericulture* and *pomology* are concerned with theoretical and applied work in genetics, breeding, physiology and cultural aspects of flower crops, ornamental plants, vegetable crops and fruit crops. The program in *food science* (*horticultural processing*) is concerned with fundamental and applied work in the chemical, physical, bacteriological and nutritional aspects of vegetable and fruit products for processing. (See Food Science, page 143.)

Departmental requirements, supplementary to the material in the Graduate School Announcements, may be obtained from the Department of Horticulture.

For Graduates and Advanced Undergraduates

HORT. 101. TECHNOLOGY OF FRUITS. (3)

First semester. (Offered 1966-67) Three lectures per week. Prerequisite Hort. 6: prerequisite or concurrent Bot. 101. A critical analysis of rsearch work and application of the principles of plant physiology, chemistry, and botany to practical problems in commercial production. (Thompson.)

HORT. 103. TECHNOLOGY OF VEGETABLES. (3)

Second semester. (Offered 1967-68) Three lectures per week. Prerequisite Hort. 58; prerequisite or concurrent Bot. 101. A critical analysis of research work and application of the principles of plant physiology, chemistry, and botany to practical problems of commercial vegetable production. (Reynolds.)

HORT. 105. TECHNOLOGY OF ORNAMENTALS. (3)

First semester. Three lectures per week. Prerequisite or concurrent Bot. 101. A study of the physiological processes as related to the growth, flowering and storage or ornamental plants. (Link.)

HORT. 107, 108. WOODY PLANT MATERIALS. (3,3)

First and second semesters. Prerequisite, Bot. 11. A field and laboratory study of trees, shrubs, and vines used in ornamental plantings. (Baker,)

HORT. 114. SYSTEMATIC HORTICULTURE. (3)

First semester. Two lectures and one laboratory period a week. A study of the origin, taxonomic relationship and horticultural classification of fruits and vegetables. (Angell.)

HORT. 161. PHYSIOLOGY OF MATURATION AND STORAGE OF HORTICULTURAL CROPS. (2)

Second semester, alternate years. (Offered 1966-67) Two lectures a week. Prerequisite, Bot. 101. Factors related to maturation and application of scientific principles to handling and storage of horticulture crops. (Scott.)

HORT. 162. FUNDAMENTALS OF GREENHOUSE CROP PRODUCTION. (3)

Second semester. Three lectures per week. This course deals with a study of the commercial production and marketing of ornamental plant crops under greenhouse, plastic houses and out-of-door conditions. (Link.)

HORT. 163. PRODUCTION AND MAINTENANCE OF WOODY PLANTS. (3)

Second semester, alternate years. (Offered 1967-68) Two lectures and one laboratory period a week. Prerequisite or concurrent Hort. 62; 108. A study of the production methods and operation of a commercial nursery and the planting and care of woody plants in the landscape. (Link.)

HORT. 198. SPECIAL PROBLEMS. (2,2)

First and second semesters. Credit arranged according to work done. For major students in horticulture or botany. Four credits maximum per student. (Staff.)

For Graduates

HORT. 201, 202. EXPERIMENTAL POMOLOGY. (3,3)

First and second semesters. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in pomology. (Thompson.)

HORT. 203, 204, 205. EXPERIMENTAL OLERICULTURE. (2,2,2)

First semester and in sequence. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observation as applied to commercial practices in olericulture. (Reynolds, Snyder.)

HORT. 206. EXPERIMENTAL FLORICULTURE. (3)
First semester. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observation as applied to commercial practices in floriculture. (Link.)

HORT. 207. METHODS OF HORTICULTURAL RESEARCH. (3)
Second semester. One lecture and one four-hour laboratory period a week. A critical study of research methods which are or may be used in horticulture. (Scott.)

HORT. 210. EXPERIMENTAL PROCESSING. (2)
Second semester. Prerequisite, permission of instructor. A systematic review of scientific knowledge and practical observations as applied to commercial practices in processing. (Kramer.)

HORT. 302. ADVANCED SEMINAR. (1,1)
First and second semesters. Oral reports with illustrative material are required on special topics or recent research publications in horticulture. Three credit hours maximum allowed toward the M.S. degree or six credits maximum toward the Ph.D. degree. (Staff.)

HORT. 399. ADVANCED HORTICULTURAL RESEARCH. (1-12)
First and second semesters; summer session. Credit granted according to work completed. (Staff.)

EXPERIMENTAL PROCEDURES IN AGRICULTURAL SCIENCES, see Agriculture, Agr. 210. (Haut.)

FOOD SCIENCE (Horticultural Processing)

For Graduates and Advanced Undergraduates

FD. SC. 102. PRINCIPLES OF FOOD PROCESSING I. (3)
Second semester. Two lectures and one laboratory per week. A study of the basic methods by which foods are preserved (unit operations). Effect of raw product quality and the various types of processes on yield and quality of the preserved products. (Wiley.)

FD. SC. 103. PRINCIPLES OF FOOD PROCESSING II. (3)
First semester. Three lectures per week. (See Dairy Science, Fd. Sc. 103)

FD. SC. 111. FOOD CHEMISTRY. (3)
First semester. Two lectures and one laboratory per week. (See Dairy Science, Fd. Sc. 111)

FD. SC. 112. ANALYTICAL QUALITY CONTROL. (3)
Second semester. Two lectures and one laboratory per week. Instrumental and sensory measurement of food quality attributes including appearance, rheological, flavor, and microbiological evaluations, and their integration into grades and standards of quality. (Kramer.)

Fd. Sc. 113. Statistical Quality Control. (3)
First semester. Two lectures and one laboratory per week. Statistical methods for acceptance sampling of supplies and raw materials, in-plant and finished product inspection, water, fuel, and waste control, production transportation, inventory and budget controls. (Kramer.)

Fd. Sc. 125. Meat and Meat Processing. (3)
First semester. Two lectures and one laboratory per week. (See Animal Science, Fd. Sc. 125)

Fd. Sc. 131. Food Product Research and Development. (3)
Second semester. Two lectures, one laboratory per week. A study of the research and development of new, economically feasible and marketable food products. Application of chemical-physical characteristics of ingredients to produce optimum quality products, cost reduction, consumer evaluation, equipment and package development. (Staff.)

Fd. Sc. 156. Horticultural Products Processing. (3)
Second semester. Two lectures and one laboratory per week. Laboratory fee $5.00. Commercial methods of canning, freezing, dehydrating, fermenting, and chemical preservation of fruit and vegetable crops. (Wiley.)

Fd. Sc. 160. Technology of Market Eggs and Poultry. (3)
First semester. Two lectures and one laboratory per week. (See Poultry Science, Fd. Sc. 160)

Fd. Sc. 182. Dairy Products Processing. (3)
Second semester. Two lectures and one laboratory per week. (See Dairy Science, Fd. Sc. 182)

Fd. Sc. 198. Special Problems in Food Science. (2, 2) (4 cr. max.)
First and second semesters. Prerequisite, approval of staff. Designed for advanced undergraduates in which specific problems in food science will be assigned. (Staff.)

Mechanics of Food Processing, see Agricultural Engineering, Agr. Engr. 113.

Experimental Food Science, see Home Economics, Food 153.

For Graduates

Experimental Processing, see Horticulture, Hort. 210.

Research Methods, see Dairy Science, An. Sci. 241.

Methods of Horticultural Research, see Horticulture, Hort. 207.

Special Problems in Animal Science, see Animal Science, Dairy Science and Poultry Science, An. Sci. 301.

Fd. Sc. 302. Advanced Seminar. (1)

First and second semesters. Oral reports with illustrative material are required on special topics or recent research publications in food science and technology. A maximum of three credit hours are allowed for the M.S. degree or six credit hours for the doctoral degree. (Staff.)

Fd. Sc. 399. Thesis Research. (1-12)

First and second semesters; summer session. The investigation is planned and conducted under faculty supervision. Grades are awarded on completion of the thesis.

SPECIAL COURSES FOR TEACHERS OF VOCATIONAL AGRICULTURE

Hort. S115. Truck Crop Management. (1)

Summer session only. Primarily designed for teachers of vocational agriculture and extension agents. Special emphasis will be placed upon new and improved methods of production of the leading truck crops. Current problems and their solution will receive special attention. (Hollis.)

Hort. S124. Tree and Small Fruit Management. (1)

Summer session only. Primarily designed for vocational agriculture teachers and extension agents. Special emphasis will be placed upon improved commercial methods of production of the leading tree and small fruit crops. Current problems and their solution will receive special attention. (Thompson.)

Hort. S125. Ornamental Horticulture. (1)

Summer session only. A course designed for teachers of agriculture and extension agents to place special emphasis on problems of the culture and use of ornamental plants. (Link.)

SCHOOL OF LIBRARY AND INFORMATION SERVICES

Professor: Wasserman.

Associate Professor: Bundy.

Assistant Professors: Bergen and Colson.

Lecturers: Dubester, Kenner, Mills, Pellowski, Perreault, Thackston, and Walston.

OBJECTIVES

The curriculum deals with those areas of knowledge basic to the professional practice of library and information activity. The program is designed to prepare librarians and information specialists for beginning professional work in each of the specialties. This sequence of study includes a core of required courses for all students, numbering twenty-four semester hours, to which are added twelve hours of specialized and elective courses, leading to the M.L.S. degree. Courses in the School are open to qualified graduate students in other disciplines with the consent of the instructor.

For Graduates

Required Core Courses

L. 200. Introduction to Data Processing for Libraries. (3)
Survey and analysis of the potential of machines, punch cards, computers and systems analysis in relation to library functions and procedures. (Walston.)

L. 202. Introduction to Reference and Bibliography. (3)
A systematic approach to bibliographic control of recorded knowledge and the methods of securing information from various types of sources. (Dubester.)

L. 204. Communication and Libraries. (3)
Communication processes are treated and the library's role as part of the larger social context is explored. (Bergen.)

L. 206. Organization of Knowledge in Libraries, I. (3)
Introduction to basic principles of subject cataloging, alphabetical and systematic. (Mills, Perreault.)

L. 207. Organization of Knowledge in Libraries, II. (3)
Introduction to basic principles of author/title and descriptive cataloging and to problems of implementation and logistics. (Mills, Perreault.)

L. 209. History of Libraries and Their Materials. (3).
The development of publication forms and institutions set against the historical framework and the cultural forces within which such advances were made. (Colson.)

L. 211. Library Administration. (3)
An introduction to administrative theory and principles and their implications and applications to managerial activity in libraries. (Wasserman.)

L. 213. Literature and Research in the Sciences. (3)
Bibliographic organization, information structure and trends in the direction of research in the principal scientific disciplines. (Bohnert.)

OR

L. 215. Literature and Research in the Social Sciences. (3)
Bibliographic organization, information structure and trends in the direction of research in the principal fields of the social sciences. (Bergen.)

OR

L. 217. Literature and Research in the Humanities. (3)
Bibliographic organization, information structure and trends in the direction of research in the principal humanistic disciplines. (Colson.)

ELECTIVES

L. 220. Public Library in the Political Process. (3)
Seminar in the principal influences which affect the patterns of organization, support and service patterns of public libraries based upon theoretical and case studies. (Bundy.)

L. 222. Children's Literature and Materials. (3)

A survey of literature and other media of communication and the criteria in evaluating such materials as they relate to the needs, interests and capability of the child. (Pellowski.)

L. 224. Construction and Maintenance of Index Languages. (3)

This course treats the making of classification schedules, subject heading lists and thesauri and those considerations relating to the revision and extension of existing ones. (Mills.)

L. 225. Advanced Data Processing in Libraries. (3)

Analysis of retrieval systems and intensive study of machine applications in the acquisition, analysis, coding, retrieval and display of information. (Walston.)

L. 227. Seminar in Documentation and Information Systems and Their Testing and Evaluation. (3)

A survey of recent developments in the processing, arrangement, and retrieval of information, and in the procedures used in their evaluation (Mills.)

L. 228. Analytical Bibliography and Descriptive Cataloging. (3)

Concentrates on the techniques and theories appropriate to the study of bibliographic morphology and bibliographical description. (Perreault.)

L. 231. Research Methods in Library and Information Activity. (3)

The techniques and strategies of research and their implications for the definition, investigation and evaluation of library problems. (Bundy.)

L. 233. Governmental Information Systems. (3)

Analysis of the organization of the information structure and the publication and dissemination programs of the U.S., federal, state and municipal governments. (Staff.)

L. 235. Problems of Special Materials. (3)

Discusses advanced principles and practices for all technical services (in particular cataloging) applicable to maps, serials, music, audio-visual items, etc. (Perreault.)

L. 244. Medical Literature. (3)

Survey and evaluation of information sources in medicine, with emphasis upon the bibliographic organization of the field. (Staff.)

L. 245. Legal Literature. (3)

Survey and evaluation of information sources in law, with emphasis upon the bibliographic organization of the field. (Staff.)

L. 249. Seminar in Technical Services. (3)

Treatment of special administrative problems related to acquisition, cataloging and classification, circulation, and managerial controls. (Staff.)

L. 251. Introduction to Reprography. (3)

A survey of the processes and technology through which materials are made available in furthering library and information services, ranging from photography to microforms. (Staff.)

L. 253. Seminar in the Academic Library. (3)
A seminar on the academic library within the framework of higher education, treating problems of programs, collections, support, planning and physical plant. (Staff.)

L. 255. Seminar on Manuscript Collections. (3)
Analysis of the methods and philosophy of handling special papers and documentary material in a research library. (Staff.)

L. 259. Business Information Services. (3)
Survey and analysis of information sources in business, finance, and economics with emphasis upon their use in problem solving. (Staff.)

L. 261. Seminar in the Special Library and Information Center. (3)
A seminar on the development, the uses, the objectives, the philosophy and the particular systems employed in special library service. (Staff.)

L. 263. Literature of the Fine Arts. (3)
Consideration and evaluation of the resources of the fine arts, emphasizing bibliography and services contained in fine arts libraries. (Staff.)

L. 264. Seminar in the School Library. (3)
Special problems in the organization and programs unique to the library of the modern school. (Kenner.)

L. 265. Information Systems Design. (3)
A workshop oriented seminar designed to cover problems of implementation and management of various types of conventional and advanced information handling systems. (Staff.)

L. 269. Library Systems. (3)
Evolution and current patterns of regional library development, considering the economic, legal, service and management problems associated with library systems as well as the significance of state and federal programs and national information networks. (Bundy.)

L. 271. Advanced Reference Services. (3)
Theoretical and administrative considerations, analysis of research problems, and directed activity in bibliographic method and search techniques in large collections. (Staff.)

L. 273. Resources of American Libraries. (3)
Considers distribution and extent of library resources, means of surveying collections, mechanisms of inter-institutional cooperation in building collections, and means of developing research collections in special subject fields. (Staff.)

L. 275. Storytelling Materials and Techniques. (3)
Literary sources are studied and instruction and practice in oral techniques are offered. (Staff.)

L. 277. International and Comparative Librarianship. (3)
Comparative analysis of the organization and development of libraries and their programs in different nations and cultures. (Staff.)

L. 290. Independent Study. (1-3)
Prerequisite, consent of instructor. Designed to permit intensive individual study, reading or research in an area of specialized interest under faculty supervision. (Staff.)

MATHEMATICS

Professors: Cohen, Brace, Douglis, Goldhaber, Good, Horvath, Hummel, Jackson, Kuroda, J. Lehner, Martin,* Mayor, Reinhart, Stellmacher, and Walsh.

Research Professors: Bramble,* Diaz,* and Rheinboldt.**

Acting Director of Computer Science Center: Menard.**

Associate Professors: Auslander, Chu, Correl, Ehrlich, Freeman, Goldberg, Greenberg, Harris, Karp, Kleppner, G. Lehner, Martens, Pearl, Syski, and Zedek.

Research Associate Professors: Hubbard* and Jones.*

Assistant Professors: Austing,** Connell, Cook, Daniel, Dyer, Egan, Garstens, Gulick, Helzer, Henkelman, Kirwan, Maltese, McGuinness, Mikulski, Nieto, Osborn, Roselle, Sedgewick, Shepherd, Strauss, Warner, Whitley, and Willke.

Research Assistant Professor: Ortega.**

Lecturer: Schweppe.**

Persons interested in graduate study in mathematics should obtain from the Graduate Committee of the Department of Mathematics a booklet entitled "Departmental Policies Concerning Graduate Students," which contains detailed information concerning admission to graduate study, the requirements for the master's and doctor's degrees, the written examination, graduate student support, and other matters.

A student majoring in a subject other than mathematics who intends to present a minor in mathematics should obtain approval of his minor program from the Advisor on Minors at an early stage of his work. The name of the current advisor may be obtained from the Graduate Committee Office.

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*Member of the Institute for Fluid Dynamics and Applied Mathematics.
**Member of the Computer Science Center.

The Mathematics Department Colloquium meets frequently throughout the academic year for reports on current research by the resident staff, visiting lecturers, and graduate students. In addition, the Institute for Fluid Dynamics and Applied Mathematics Colloquium meets at frequent intervals for reports on research in those fields. All colloquium meetings are open to the public. Several seminars meet regularly for the discussion of current developments in special fields. Graduate students are invited to participate.

COURSES

Courses numbered 100-199 are open to graduate and properly qualified undergraduate students. Courses numbered 200 and above are open only to graduate students.

COURSES IN ALGEBRA:

100, 103, 104, 106
200, 201, 204, 205, 206, 208, 209, 271.

COURSES IN ANALYSIS:

110, 112, 113, 114, 117, 118, 119, 162, 163, 164
215, 216, 218, 219, 272, 278, 280, 281, 286, 287, 288, 289.

COURSES IN GEOMETRY AND TOPOLOGY:

120, 121, 122, 123, 124, 126, 128
204, 205, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 273.

COURSES IN APPLIED AND NUMERICAL MATHEMATICS:

158, 170, 171, 172, 173
255, 256, 257, 265, 266, 267, 268, 269, 274.

COURSES IN PROBABALITY AND STATISTICS:

130, 131, 132, 133, 134
230, 231, 232, 235, 236, 275, 276.

COURSES IN LOGIC AND FOUNDATIONS:

146, 147, 148
244, 277.

COURSES FOR TEACHERS OF MATHEMATICS AND SCIENCE:

181, 182, 183, 184, 185, 189.

SEMINARS AND RESEARCH:

190, 191
399.

MATH. 100. VECTORS AND MATRICES. (3)

Prerequisite, Math. 21 or Math. 15. Algebra of vector spaces and matrices. Recommended for students interested in the applications of mathematics. (Pearl.)

MATH. 103. INTRODUCTION TO ABSTRACT ALGEBRA I (3)

Prerequisite, Math 22 or equivalent. Integers; groups, rings, integral domains, fields. (Ehrlich.)

Math. 104. Introduction to Abstract Algebra II (3)

Prerequisite, Math. 103 or consent of instructor. An abstract treatment of finite dimensional vector spaces. Linear transformations and their invariants. (Ehrlich.)

Math. 106. Introduction to Number Theory. (3)

Prerequisite, Math. 22. Integers, divisibility, Euclid's algorithm, diophantine equations, prime numbers, congruences, reciprocity law of quadratic residues, quadratic fields, binary quadratic forms. (Roselle.)

Math. 110. Advanced Calculus. (4)

Prerequisite, Math 22. A rigorous development of many topics from classical analysis such as the Stieltjes integral, surface integrals, sequences and series of functions, introduction to the Dirichlet integral. (A special section for graduate students will be provided.) (Strauss.)

Math. 112. Infinite Processes. (3)

Prerequisite, Math. 21 or equivalent. Construction of the real numbers from the rational numbers, sequences of numbers, series of positive and arbitrary numbers, infinite products, conditional and absolute convergence, sequences and series of functions, uniform convergence, integration and differentiation of series, power series, and analytic functions, Fourier series, elements of the theory of divergent series, extension of the theory to complex numbers and functions. (Kirwan.)

Math. 113. Introduction to Complex Variables. (4)

Prerequisite, Math. 110. The algebra of complex numbers, analytic functions, mapping properties of the elementary functions. Cauchy's theorem and the Cauchy integral formula. Taylor and Laurent series. Residues. (Credit will be given for only one of the courses Math 113 and Math 163.) (Hummel.)

Math. 114. Differential Equations. (3)

Prerequisite, Math. 110. A general introduction to the theory of differential equations. Constructive methods of solution leading to existence theorems and uniqueness theorems. Other topics such as: systems of linear equations, the behavior of solutions in the large, the behavior of solutions near singularities, periodic solutions, stability, and Sturm-Liouville Problems. (Auslander.)

Math. 117. Introduction to Fourier Analysis. (3)

Prerequisite, Math. 113. Fourier series. Fourier and Laplace transforms. (Maltese.)

Math. 118. Introduction to Real Variables. (3)

Prerequisite, Math. 110. The Lebesgue integral. Fubini's theorem. Convergence ence theorems. The L_p spaces. (Freeman.)

Math. 119. Several Real Variables. (3)

Prerequisite, Math 110. A brief review of scalar and vector valued functions of several real variables (as done in Math 22). Implicit function theorem, change of variable theorem for multiple integrals, a detailed study of surfaces and surface integrals in n-dimensional Euclidean space, including integration by parts. Applications to partial differential equations and potential theory. (Harris.)

MATH. 120. INTRODUCTION TO GEOMETRY I. (3)

Prerequisite, Math. 22 or equivalent. Axiomatic development of plane geometries, Euclidean and non-Euclidean. Groups of isometries and similarities. (Reinhart.)

MATH. 121. INTRODUCTION TO GEOMETRY II. (3)

Prerequisite, Math. 120. Non-Euclidean transformation groups, the Erlangen program, projective planes, cubics and quartics. (Reinhart.)

MATH. 122. INTRODUCTION TO POINT SET TOPOLOGY. (3)

Prerequisite, Math. 110 or 146, or equivalent. Connectedness, compactness, transformations, homeomorphisms; application of these concepts to various spaces, with particular attention to the Euclidean plane. (Kleppner.)

MATH. 123. INTRODUCTION TO ALGEBRAIC TOPOLOGY. (3)

Prerequisite, Math. 122 and 103, or equivalent. Chains, cycles, homology groups for surfaces, the fundamental group. (G. Lehner.)

MATH. 124. INTRODUCTION TO PROJECTIVE GEOMETRY. (3)

Prerequisite, Math. 22 or equivalent. Recommended for students in the College of Education. Elementary projective geometry, combining synthetic and algebraic approaches, projective transformations, harmonic division, cross ratio, projective coordinates, properties of conics. (Correl.)

MATH. 126. INTRODUCTION TO DIFFERENTIAL GEOMETRY. (3)

Prerequisite, Math. 22 or equivalent. The differential geometry of curves and surfaces, curvature and torsion, moving frames, the fundamental differential forms, intrinsic geometry of a surface. (Jackson.)

MATH. 128. EUCLIDEAN GEOMETRY. (3)

Prerequisite, Math. 22 or equivalent. Recommended for students in the College of Education. Axiomatic method, models, properties of axioms; proofs of some basic theorems from the axioms; modern geometry of the triangle, circle, and sphere. (Correl.)

MATH. 130. INTRODUCTION TO PROBABILITY THEORY I. (3)

Prerequisite, Math. 110, or equivalent. Sample space, events, probability and its basic properties. Independence and conditioning, random variables, distribution functions (continuous and discrete); typical distributions, expectations, moments, generating functions; transformations of random variables, limit theorems. (Syski.)

MATH. 131. INTRODUCTION TO PROBABILITY THEORY II. (3)

Prerequisite, Math. 130. Elementary stochastic processes. Renewal process, random walk, discrete Markov chains, birth processes, birth and death processes, stationary processes. (Daniel.)

MATH. 132. INTRODUCTION TO STATISTICS. (3)

(Three lectures and 1 hour of laboratory a week.)
Prerequisite, Math. 130. Sampling distributions, elements of point and set estimation. maximum likelihood principle, testing statistical hypotheses, standard tests, Neyman-Pearson lemma and problems of optimality of tests. linear hypotheses, sequential methods. (Mikulski.)

Math. 133. Applied Probability and Statistics I. (3)

Prerequisite, Math. 15 or 21. Recommended for students with major other than mathematics. Probability concepts in finite sample spaces, generalizations to continuous case (intuitive approach), random variables and distribution functions standard distributions, expectations, moments and generating functions, limit theorems. (Willke.)

Math. 134. Applied Probability and Statistics II. (3)

Prerequisite. Math. 133. Sampling distributions, estimation methods, standard procedures in testing statistical hypotheses, testing location and scale parameters, tests of independence and goodness of fit, elements of variance and regression analysis. (Willke.)

Math. 146. Fundamental Concepts of Mathematics. (3)

Prerequisite, Math. 22 or consent of instructor. Sets, relations, mappings. Construction of the real number system starting with Peano postulates; algebraic structures associated with the construction: Archimedean order, sequential completeness and equivalent properties of ordered fields. Finite and infinite sets, denumerable and non-denumerable sets. (Cohen.)

Math. 147. Set Theory. (3)

Prerequisite, Math. 22 or consent of instructor. Set Algebra, cardinal arithmetic, axiom of choice, Zorn's lemma, well-ordering principle, transfinite induction, ordinal arithmetic, continuum hypothesis. (Karp.)

Math. 148. Introduction to Mathematical Logic. (3)

Prerequisite. Math. 146 or 147 or 103. Propositional calculus, predicate logic, axiomatic set theory, paradoxes. (Not open to students with credit for Math. 144). (Karp.)

Math. 158. Games and Linear Relations. (3)

Prerequisite. Math. 22; Math. 100 recommended. Theory of games, minimax theorem, theory of linear programming, simplex method, systems of linear inequalities and the nature of their solutions, geometrical interpretations. (Pearl.)

Math. 162. Analysis for Scientists and Engineers I. (3)

Prerequisite. Math. 21 or consent of instructor. Not open to students with credit for Math. 22. Calculus of functions of several real variables; limits, continuity, partial differentiation, multiple integrals, line and surface integrals, vector-valued functions, theorems of Green, Gauss and Stokes. Physical applications. (This course cannot be counted toward a major in mathematics.) (Sedgewick.)

Math. 163. Analysis for Scientists and Engineers II. (3)

Prerequisites. Math. 162 or 22 or consent of instructor. The complex field. Infinite processes for real and complex numbers. Calculus of complex functions. Analytic functions and analytic continuation. Theory of residues and application to evaluation of integrals. Conformal mapping. (Credit will be given for only one of the courses. Math. 113 and Math. 163.) (Sedgewick.)

Math. 164. Analysis for Scientists and Engineers III. (3)

Prerequisite, Math. 64 and Math. 163, or consent of instructor. Fourier and Laplace transforms. Evaluation of the complex inversion integral by the theory of residues. Applications to systems of ordinary and partial differential equations. (Stellmacher.)

Math. 170. Introduction to Numerical Analysis. (4)*

Prerequisite. Math. 21 or Math. 15. Introduction to numerical methods. errors. interpolations. differences. numerical differentiation and integration, integrative solution of equations, least squares. elements of numerical approximation. (Cook.)

Math. 171. Numerical Methods in Linear Algebra. (4)*

Prerequisite, Math. 100 or 104. Math. 110, Math. 170. Numerical solution of linear equations. direction methods, iterative methods. eigenvalue problems and their numerical solution, errors connected with numerical work in linear algebra. (Cook.)

Math. 172. Numerical Solution of Ordinary Differential Equations. (4) *

Prerequisite, Math. 22 or 162 and Math. 171. The methods of Euler, Runge. Kutta, and other single step-methods. multistep methods, discretization errors. stability problems. (Rheinboldt.)

Math. 173. Numerical Methods for Scientists and Engineers. (4)*

Prerequisite, Math. 22 or 162 and Math. 64. Interpolation, numerical differentiation and integration, numerical solution of polynominal and transcendental equations, least squares, systems of linear equations, numerical solution of ordinary differential equations, errors in numerical calculations. (Rheinboldt.)

Math. 181. Introduction to Number Theory. (3)

Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Axiomatic developments of the real numbers. Elementary number theory.

Math. 182. Introduction to Algebra. (3)

Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Modern ideas in algebra and topics in the theory of equations.

Math. 183. Introduction to Geometry. (3)

Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the axioms for Euclidean and non-Euclidean geometry.

Math. 184. Introduction to Analysis. (3)

Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching

*Three lectures and two laboratory periods per week.

of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the limit concept and the calculus. (Previous knowledge of calculus is not required.)

MATH. 185. SELECTED TOPICS FOR TEACHERS OF MATHEMATICS. (1-3)

Prerequisite, one year of college mathematics or consent of instructor.

MATH. 189. NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTE FOR TEACHERS OF SCIENCE AND MATHEMATICS. SEMINAR. (1-3)

Lectures and discussions to deepen the student's appreciation of mathematics as a logical discipline and as a medium of expression. Special emphasis on topics relevant to current mathematics curriculum studies and revisions.

MATH. 190. HONORS SEMINAR. (2)

Prerequisite, permission of the departmental Honors Committee. Reports by students on mathematical literature; solution of various problems. (Ehrlich.)

MATH. 191. SELECTED TOPICS IN MATHEMATICS. (Credit according to work done.)

Prerequisite, permission of the instructor. Topics of special interest to advanced undergraduate students will be offered occasionally under the general guidance of the departmental Committee on Undergraduate Studies. Honors students register for reading courses under this number. (Staff.)

MATH. 200. ABSTRACT ALGEBRA I. (3)

Prerequisite, Math. 104 or equivalent. Groups with operators, homorophism and isomorphism theorems, normal series, Sylow theorems, free groups, abelian groups. Modules, tensor products. Integral domains. Field theory, Galois theory. (Ehrlich.)

MATH. 201. ABSTRACT ALGEBRA II. (3)

Prerequisite, Math. 200 or consent of instructor. Dedekind domains. Noetherian domains, Hilbert Nullstellensatz. Rings with minimum condition. Wedderburn theorems. Introduction to homological algebra. (Goldhaber.)

MATH. 204, 205. TOPOLOGICAL GROUPS. (3, 3)

Prerequisites, Math. 286 and Math. 289 or Math. 225, or consent of instructor. General nature of topological groups including homomorphism theorems, Haar measure, representations of compact groups and the Peter-Weyl Theorem, Pontrjagin duality and the Plancherel Theorem. (Kleppner.)

MATH. 206. NUMBER THEORY. (3)

Prerequisite, consent of instructor. Foundations, linear and higher congruences, law of reciprocity, quadratic forms, sieve methods, elements of additive number theory and density, distribution of prime numbers and L-functions, discussion of unsolved problems. (Kuroda.)

MATH. 208. RING THEORY. (3)

Prerequisite, Math. 201 or consent of instructor. According to the needs of the class, emphasis will be placed on one or more of the following: ideal theory, structure theory of rings with or without minimum condition, division rings, algebras, non-associative rings. (Pearl.)

MATH. 209. GROUP THEORY (3)

Prerequisite, Math. 201 or consent of instructor. According to the needs of the class, emphasis will be placed on one or more of the following aspects of discrete group theory: finite groups, abelian groups, free groups, solvable or nilpotent groups. groups with operators, groups with local properties, groups with clan conditions, extensions. (Pearl.)

MATH. 215, 216. ADVANCED ORDINARY DIFFERENTIAL EQUATIONS. (3, 3)

Prerequisite, Math. 286 and either Math. 100 or Math. 104. Existence and uniqueness theorems for systems of differential equations, linear theory, properties of solutions of differential equations including stability, asymptotic behavior, oscillation and comparison theorems. Plane autonomous systems. Nonlinear systems. Topics of current interest. (Strauss.)

MATH. 218, 219. FUNCTIONAL ANALYSIS. (3, 3)

Prerequisite, Math. 286, 287. Normed linear spaces including Banach and Hilbert spaces, linear operators and their spectral analysis with application to differential and integral equations. (Whitley.)

MATH. 220. DIFFERENTIAL GEOMETRY OF CURVES AND SURFACES. (3)

Prerequisite, Math. 110 or equivalent. Classical theory of curves and surfaces, geometry in the large, the Gauss-Bonnet Theorem, surfaces of constant curvature. (Jackson.)

MATH. 221. DIFFERENTIABLE MANIFOLDS. (3)

Prerequisite, consent of instructor. Differentiable manifolds, embeddings in Euclidean space, vector and tensor bundles, vector fields, differentiable fields, Riemann metrics. (Reinhart.)

MATH. 222. DIFFERENTIAL GEOMETRY. (3)

Prerequisite, Math. 220 or 221. Connections, curvature, torsion; symplectic, contact, and complex structures. (Reinhart.)

MATH. 223, 224. ALGEBRAIC TOPOLOGY. (3, 3)

Prerequisites, Math. 200 and 225, or consent of instructor. Homology, cohomology, and homotopy theory of complexes and spaces. (G. Lehner.)

MATH. 225, 226. SET THEORETIC TOPOLOGY. (3, 3)

Prerequisite, concurrent enrollment in Math. 286, or equivalent. Foundations of mathematics based on a set of axioms, metric spaces, convergence and connectivity properties of point sets, continua, and continuous curves; the topology of the plane. (Correl.)

MATH. 227, 228. ALGEBRAIC GEOMETRY. (3, 3)

Prerequisite, consent of instructor. Prime and primary ideals in Noetherian rings, Hilbert Nullstellensatz. places and valuations, fields of definition, Chow points, birational correspondences, Abelian varieties, Picard varieties, algebraic groups. (Horvath.)

MATH. 229. DIFFERENTIAL TOPOLOGY. (3)

Prerequisite, Math. 221. Characteristic classes, cobordism, differential structures on cells and spheres. (Chu.)

MATH. 230, 231. PROBABILITY THEORY. (3, 3)

Prerequisite, Math. 110 and 130 or consent of instructor. Foundations of probability theory. Fields of events, probability space and probability measure. Random variables and convergence of random variables. Induced probability spaces. Expectations and moments. Distribution functions and their transforms. Consistency theorem. Laws of large numbers and central limit problem. Conditioning. Measurability and separability of stochastic processes. Stationary processes, harmonic analysis, Markov process, Kolmogorov equations, diffusion theory. Martingales. (Syski.)

MATH. 232. APPLIED STOCHASTIC PROCESSES. (3)

Prerequisites, Math. 110 and 130 or consent of instructor. Basic concepts of stochastic processes, stationary processes. Markov chains and processes (discrete and continuous parameter). Birth and death processes. Applications from theories of: queueing, storage, inventory, noise, epidemics and others. This course is recommended for graduates from Physics, Engineering, Biology and Social Sciences. (Connell.)

MATH. 235, 236. TESTING STATISTICAL HYPOTHESES. (3, 3)

Prerequisites, Math. 130 and 132. (Recommended to be concurrent with Math. 230, 231). Statistical decision problems. Uniformly most powerful tests. Exponential families of distributions, concepts of similarity and tests with Neyman-structure. Unbiased tests. Invariance and almost invariance. Elements of non-parametric inference. Linear hypotheses. Large sample methods. (Mikulski.)

MATH. 244. MATHEMATICAL LOGIC. (3)

Prerequisite, Math. 148. Completeness of first-order predicate logic and applications, recursive functions, Godel's incompleteness theorem. (Karp.)

MATH. 255, 256. ADVANCED NUMERICAL METHODS IN DIFFERENTIAL EQUATIONS. (3, 3)

Prerequisites, Math. 257 and Math. 265. Approximation methods for boundary value, initial value and eigenvalue problems in both ordinary and partial differential equations, including finite differences and methods involving approximating functions. (Hubbard.)

MATH. 257. OPERATORS ON NORMED SPACES. (3)

Prerequisite, Math. 110. An introduction to linear analysis, in particular to those concepts and methods important in modern applied mathematics. Among the topics to be covered are linear spaces, norms and inner products, linear operators, eigenvalues, basic inequalities. (Nieto.)

MATH. 265. PARTIAL DIFFERENTIAL EQUATIONS I. (3)

Prerequisite, Math. 114 or consent of instructor. Gauss and Green formulas, the Cauchy problem for the wave equation, method of descent and Huygens principle. The Dirichlet and Neumann problem for the Laplace equation, single and double layer potentials, Green functions, the method of integral equations. (Hubbard.)

MATH. 266. PARTIAL DIFFERENTIAL EQUATIONS II. (3)

Prerequisite, Math. 265. Introduction to modern theories in partial differential equations. Topics include: existence and uniqueness questions, concepts of weak and strong solutions, applications of functional analysis. (Hubbard.)

MATH. 267, 268. MODERN NUMERICAL MATHEMATICS. (3, 3)

Prerequisites, Math. 170 and Math. 257. Review of classical numerical analysis, matrix computations in particular numerical evaluation of eigenvalues, interative techniques from a viewpoint of linear analysis; introduction to numerical approximations; error analysis in numerical computation. The course will involve laboratory work in the Computer Science Center. (Rheinboldt.)

MATH. 269. ADVANCED MATHEMATICAL PROGRAMMING. (3)

Prerequisites, Math. 158 and Math. 257. Linear inequalities and related systems and their applications to linear programming, convex functions and generalized programming problems, topics in non-linear and dynamic programming. (Rheinboldt.)

MATH. 271. SELECTED TOPICS IN ALGEBRA. (3)

(Arranged) Prerequisite, consent of instructor. Courses in the following subjects may be given: homological algebra, commutative algebra, class field theory, Lie groups and algebras. (Staff.)

MATH. 272. SELECTED TOPICS IN ANALYSIS. (3)

Prerequisite, consent of instructor. Material selected to suit interests and background of the students. Typical courses: harmonic analysis, singular integral operators, spectral theory, differential equations in Hilbert space. (Staff.)

MATH. 273. SELECTED TOPICS IN GEOMETRY AND TOPOLOGY. (3)

(Arranged) Prerequisite, consent of instructor. (Staff.)

MATH. 274. SELECTED TOPICS IN APPLIED MATHEMATICS. (3)

Prerequisite, consent of instructor. Material selected to suit interests and background of the students. Typical courses: special functions, variational methods, continuum mechanics, fluid dynamics, elasticity. (Staff.)

MATH. 275. SELECTED TOPICS IN PROBABILITY. (3)

(Arranged) Prerequisite, consent of instructor. (Staff.)

MATH. 276. SELECTED TOPICS IN STATISTICS. (3)

(Arranged) Prerequisite, consent of instructor. (Staff.)

MATH. 277. SELECTED TOPICS IN MATHEMATICAL LOGIC. (3)

(Arranged) Prerequisite, consent of instructor. (Staff.)

MATH. 278. ADVANCED TOPICS IN COMPLEX ANALYSIS. (3)

Prerequisite, consent of instructor. Material selected to suit interests and background of the students. Typical courses: interpolation and approximation, Riemann surfaces, automorphic functions, several complex variables, symmetric spaces. (Staff.)

MATH. 280, 281. LINEAR SPACES. (3, 3)

Prerequisite, Math. 218. Linear topological spaces, locally convex spaces, duality theory, distributions. (Goldberg.)

MATH. 286. REAL ANALYSIS I. (3)

Prerequisite, Math. 110 or equivalent. Sets. Metric spaces. Lebesgue measure and integration. Differentiation. Introduction to Banach and Hilbert spaces. (Whitley.)

Math. 287. Complex Analysis I. (3)

Prerequisite, Math. 110 or equivalent. Linear transformations, analytic functions, conformal mappings, Cauchy's theorem and applications, power series, partial fractions and factorization, elementary Riemann surfaces, Riemann's mapping theorem. (Kirwan.)

Math. 288. Complex Analysis II. (3)

Prerequisite, Math. 287, 286. Topics in conformal mappings, normal families, Picard's theorem, classes of univalent functions, extremal properties, variational methods, elliptic functions, Riemann surfaces. (Zedek.)

Math. 289. Real Analysis II. (3)

Prerequisite, Math. 286, 287. General topology. Measure theory. L_p spaces. Fourier transforms. Locally compact spaces. (Douglis.)

Math. 399. Research.

(Arranged) (Staff.)

MECHANICAL ENGINEERING

Professors: Shreeve, Jackson, R. W. Allen, Sayre, Talaat, and Mavis.

Associate Professors: Hayleck, Eyler, Wockenfuss, Berger, Cunniff, and J. Asimow.

Assistant Professors: Elkins, Walston, Anand, Marks, and Yang.

Lecturers: Dawson, Meyerson, Haberman, and Seigel.

Instruction and research facilities are available for the degrees of Master of Science and Doctor of Philosophy in mechanical engineering.

For the Master of Science degree in mechanical engineering a minimum of six semester hours of course work in mechanical engineering must be taken in classes conducted by members of the resident graduate faculty. For the Doctor of Philosophy degree, the minimum is eighteen semester hours.

Registration for six credits of research (M.E. 399, Research) for the M.S. degree and twelve credits for the Ph.D. degree are required. It is the policy of the Department to require that this research be conducted in the Department laboratories. Arrangements for the research and for faculty supervision must be made, and approved by the Department Chairman, well in advance of the registration for the research in order that the funds and equipment may be made available.

For Graduates and Advanced Undergraduates

M.E. 100. Thermodynamics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Phys. 20, Math. 21, concurrently. The properties, characteristics, and funda-

mental equations of gases and vapors. Application of the first and second laws of thermodynamics in the analysis of basic heat engines, air compression, and vapor cycles. Flow and non-flow processes for gases and vapors. (Eyler, Allen, Talaat.)

M.E. 101. Dynamics of Machinery. (2)

First semester. One lecture and one laboratory period a week. Prerequisites, E. S. 21; Math 64 concurrently. Kinematics of mechanisms, and dynamic characteristics of machinery with emphasis on systems with single degree of freedom. (Hayleck, McAuliffe, Yang.)

M.E. 102. Fluid Mechanics I. (3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites. M. E. 1. Laboratory fee, $3.00. A rational study of fluids at rest and in motion. Principles of viscous and turbulent flow in pipes, nozzles, etc. Impulse and momentum concepts. Pumps, turbines, and meters. Dimensional analysis and laws of similarity. (Sayre, John.)

M.E. 103. Materials Engineering. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite. E. S. 30. Laboratory fee, $8.00. Processes and methods to manufacture and usefully apply engineering materials; alloys and heat treatment of steel; strengthening processes for ferrous and non-ferrous alloys. Fabrication techniques for metals, polymers, and refractories. Specification, inspection, control and automation. (Jackson, Tabler.)

M.E. 104. Gas Dynamics. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite. M. E. 102. Compressible flow in ducts and nozzles; effect of area change, heat addition, friction, and normal shocks. Thermodynamics of chemically reacting flows, combustion and equilibrium. (Sayre.)

M.E. 105. Principles of Mechanical Engineering. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 21, Math 21. Required of seniors in civil engineering. Elementary thermodynamics and the study of heat, fuel and combustion in the production and use of steam for generation of power. Supplemented by laboratory tests and trips to industrial plants. (Glass, Marks.)

M.E. 106. Transfer Processes. (3)

First and second semesters. Three lectures a week. Prerequisite, M. E. 102. Conduction by steady state and variable heat flow; laminar and turbulent flow; free and forced convection; radiation, evaporation and condensation of vapors. Analogy between the transfer of mass, heat, and momentum. (Allen, Eyler.)

M.E. 107. Energy Conversion. (4)

Second semester. Three lectures and one laboratory a week. Prerequisite, M. E. 100. Laboratory fee, $3.00 per semester. Required of seniors in electrical engineering. Chemical, heat, mechanical, nuclear and electrical energy conversion processes, cycles and systems. Direct conversion processes of fuel cells, thermionics, and magnetohydromechanics. (Allen, Talaat.)

M.E. 116. Applied Mathematics in Engineering.

Prerequisite: Math. 21. Mathematical techniques applied to the analysis and solution of engineering problems. Use of differentiation, integration, differential equations, partial differential equations and integral transforms. Application of infinite series, numerical and statistical methods.

M.E. 120. Measurements Laboratory. (2)

Second semester. One lecture and one laboratory period a week. Prerequisites, E. S. 30, M. E. 101, nd E. E. 51; M. E. 106 concurrently. Lab Fee $8.00. Required of juniors in Mechanical Engineering. Measurements and measurement systems; applications of selected instruments with emphasis on interpretation of results. (McAuliffe, Glass.)

M.E. 140. Engineering Analysis and Computer Programming. (3)

Second semester. Three lectures a week. Prerequisite, Math. 64. Elements of operational calculus, vector analysis; numerical methods and programming for computers. Errors, interpolation, series, integration, interation and solution of equations. (Yang.)

M.E. 150, 151. Energy Conversion. (4, 3)

First semester. Three lectures, one laboratory a week. Second semester. Two lectures, one laboratory a week. Prerequisites, M. E. 103, M. E. 104, M. E. 106. Chemical, heat, mechanical, nuclear and electrical energy conversion processes, cycles and systems. Reciprocating, turbo- and jet-propulsion power plants and components using all types of heat and reaction sources. Direct conversion processes of fuel cells, thermionics and magnetohydromechanics. (Shreeve, John.)

M.E. 152. Machine Design. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, M. E. 101, 103. Working stresses, stress concentration, stress analysis and repeated loadings. Design of machine elements. Multidegree vibration systems. (Hayleck, Jackson.)

M.E. 153. Elasticity and Plasticity I. (3)

Second semester. Three lectures a week. Prerequisite, M. E. 152. Analysis of plates and shells, thick walled cylinders, columns, torsion of non-circular sections, and rotating disks. (Hayleck, Jackson, Berger.)

M.E. 154, 155. Engineering Experimentation. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, senior standing in Mechanical Engineering. Laboratory fee, $8.00 per semester. Theory of experimentation. Selected experiments emphasize planned procedure, analysis and communications of results, analogous systems and leadership. (Allen, Sayre.)

M.E. 156, 157. Mechanical Engineering Analysis and Design. (3, 4)

First semester, two lectures, one laboratory period per week; second semester, two lectures and two laboratory periods per week. Prerequisite, senior standing in Mechanical Engineering. Creative engineering and problem analysis. Systems design including control, reliability and manufacturing requirements. Use of computers in design. Design of multi-variable systems. (Sayre, Berger, Cunniff.)

M.E. 161. Environmental Engineering. (3)

Second semester. Three lectures a week. Prerequisite, M. E. 101. 106, senior standing in Mechanical Engineering. Heating and cooling load computations. Thermodynamics of refrigeration systems. Low temperature refrigeration. Problems involving extremes of temperature, pressure, acceleration and radiation. (Eyler.)

M.E. 162. Dynamics II. (3)

Three lectures a week. Prerequisites, M. E. 101, Math. 64, senior standing in Mechanical Engineering. Linear and non-linear plane and three-dimensional motion, moving axes. Lagrange's equation, Hamilton's principle, non-linear vibration, gyroscope, celestial mechanics. (Cunniff.)

M.E. 163. Fluid Mechanics II. (3)

Three lectures a week. Prerequisites, M. E. 104, M. E. 106, senior standing. Hydrodynamics with engineering applications. Stream function and velocity potential; conformal transformations; pressure distributions; circulation; numerical methods and analogies. (Sayre, John.)

M.E. 164. Thermodynamics II. (3)

Three lectures a week. Prerequisites, M. E. 104, M. E. 106, senior standing. Applications to special systems, change of phase, low temperature. Statistical concepts, equilibrium, heterogenous systems. (Eyler, Allen.)

M.E. 165. Automatic Controls. (3)

Three lectures per week. Prerequisites, E. E. 52, senior standing. Hydraulic, electrical, mechanical and pneumatic automatic control systems. Open and closed loops. Steady state and transient operation, stability criteria, linear and non-linear systems. Laplace transforms. (Yang.)

M.E. 166. Special Problems. (3)

Three lectures a week. Prerequisite, senior standing in Mechanical Engineering. Advanced problems in Mechanical Engineering with special emphasis on mathematical and experimental methods. (Staff.)

M.E. 167. Introduction to Operations Research I. (3)

Three lectures a week. Prerequisite, senior standing in Mechanical Engineering. Applications of linear programming, queuing model, theory of games and competitive models to engineering problems.

M.E. 168, 169. Solid State for Engineers. (3, 3)

Three lectures a week. Prerequisite, E. S. 30. Advanced study of the behavior of solid materials. Structure of matter: equilibrium and rate processes; metallic and molecular solids; theory of dislocation; mechanical, thermal, electrical, optical, and other properties. (Asimow.)

For Graduates

M.E. 200, 201. Advanced Dynamics. (3, 3)

First and second semesters. Prerequisites. E. S. 21, Math. 64, M. E. 157. Mechanics of machinery. Dynamic force. Balancing of rotating parts. Vibrations and vibration damping. Critical speeds. (Cunniff.)

M.E. 202, 203. Applied Elasticity. (3, 3)

First and second semesters. Prerequisites, E. S. 20, Math. 64, M. E. 153. Advanced methods in structural and experimental stress analysis. Advanced strength of materials involving beam problems, curved bars, thin plates and shells, buckling of bars, plates and shells, etc. Advanced work in stress concentrations, plastic deformations, etc., and problems involving instability of structures. (Berger.)

M.E. 204, 205. Advanced Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M. E. 104, M. E. 106, M. E. 151, Math. 64. Advanced problems in thermodynamics on compression of gases and liquids, combustion and equilibrium, and availability. Statistical thermodynamics transport phenomena, partition functions. (Shreeve, Allen.)

M.E. 206, 207. Advanced Machine Design. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, M. E. 153, M. E. 157. Application of advanced methods of stress analysis to design of stationary and moving machine parts and structures. Properties and characteristics of materials and their relationship to design. (Jackson.)

M.E. 208, 209. Design of Turbomachinery. (3, 3)

First and second semesters. Prerequisite, M. E. 151. Characteristics and design of turbines, pumps, compressors and torque converters; cavitation, stall, and surge. (Shreeve.)

M.E. 210, 211. Advanced Fluid Mechanics. (3, 3)

First and second semesters. Prerequisites, M. E. 102, Math. 64 or equivalent. Potential flow theory; three dimensional flow examples; application of complex variables to two-dimensional flow problems; Blasius theorem, circulation and Joukowski hypothesis, engineering applications to cavitation prediction and calculation of pressure distribution; introduction to viscous flow and theory of the boundary layer. (Sayre, Haberman.)

M.E. 212, 213. Advanced Vibrations. (3, 3)

First and second semesters. Prerequisite, M. E. 157. Review of single and multi-degrees of freedom. Laplace methods. Effects of pulse shape on response of linear and non-linear systems; friction, hysterisis and variable damping. (Cunniff.)

M.E. 214, 215. Stress Waves in Continuous Media. (3, 3)

First and second semesters. Prerequisite, M. E. 153 and M. E. 157. Method of characteristics applied to transient phenomena in solids and fluids. Elastic and plastic waves under impact. Shock formation and strain rate effects. (Seigel.)

M.E. 216, 217. Energy Conversion Theory. (3, 3)

First and second semesters. Prerequisite. M. E. 151. Combustion, thermoelectric, thermionic, fuel cells, reactors, magnetohydrodynamics. Special emphasis on kinetics of reactions, fission and fusion. (Talaat, Shreeve.)

M.E. 218, 219. Energy Conversion Systems. (3, 3)

First and second semesters. Prerequisite, M. E. 217. Design parameters in chemical, nuclear and direct conversion systems for the production of power; weight, efficiency and radiation. (Talaat, Shreeve.)

M.E. 220. Seminar.

Credit in accordance with work outlined by mechanical engineering staff. Prerequisite, graduate standing in mechanical engineering. (Staff.)

M.E. 222. Advanced Metallography. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, M. E. 103, E. S. 20. Advanced study of the structure and properties of metals and alloys. Study of the latest developments in ferrous and non-ferrous alloys including stainless steels, high temperature steels, tool steels, aluminum, magnesium and copper alloys. Study of inspection of metals by the use of x-rays, spectrograph, metallograph and magniflux. Review of current literature. (Jackson.)

M.E. 223, 224. Theory of Plasticity. (3, 3)

First and second semesters. Prerequisite, M. E. 153. Concepts of yield criteria and associated flow rules in the theory of elastic-plastic solids, including perfectly plastic, elastic-plastic and strain-hardening materials. Torsion and plane problems of plasticity. (Jackson, Berger.)

M.E. 225, 226. Advanced Properties of Metals and Alloys. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, E. S. 20, M. E. 103, M. E. 152, M. E. 153. Properties of metals including tensile, impact, fatigue, damping capacity, hardenability, wear, etc. Fabrication problems and selection of metals and alloys. Service failures. Properties required for nuclear engineering applications. Properties of metals at elevated and extremely low temperatures. (Jackson, Meyerson.)

M.E. 227, 228. Theory of Elasticity. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M. E. 202, 203. Stress and strain at a point. Relation between stresses and strains, general equations of elasticity, plane strain and plane stress, torsion, bending, axially symmetric distribution of stress, plates, thermal stresses, strain energy and approximate methods. (Berger.)

M.E. 229, 230. Jet Propulsion. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M. E. 150, M. E. 151. Types of thermal jet units. Fluid reaction and propulsive efficiency. Performance of rockets, aerothermodynamics, combustion chemical kinetics, aerodynamics of high speed air flow. Principles and design of solid and liquid propellant rockets. Design of turbojets and aerojets, ramjets and hydroduct units, including combustion chambers, turbines and compressor. (Shreeve.)

M.E. 231, 232. Advanced Heat Transfer. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M. E. 150, M. E. 151. Advanced problems covering effects of radiation, conduction, convection, evaporation and condensation. Study of research literature on heat transfer. (Shreeve, Allen.)

M.E. 233, 234. Compressible Flow. (3, 3)

First and second semester. Prerequisites, M. E. 104, M. E. 210, Math. 64 or equivalent. One dimensional subsonic and supersonic flow; compressible flow in ducts and nozzles; two and three dimensional subsonic and supersonic flow; similarity rules, normal and oblique shock waves. (John, Sayre.)

M.E. 235, 236. Materials and Their Environment. (3, 3)

Three lectures a week. Prerequisites, M. E. 225, 226. Problems involving materials subjected to extreme temperatures, nuclear bombardment and radiation damage, corrosion and oxidation, impact and flutter, thermal shock, high pressure and high vacuum. (Asimow, Meyerson.)

M.E. 237. X-Ray and Diffraction Techniques. (3)

Two lectures and one laboratory period a week. Prerequisite, M. E. 222. Advanced work in X-Ray and diffraction techniques, electron microscopes, and optical microscopes, in the study of the structure of materials.

(Asimow.)

M.E. 399. Research.

Credit in accordance with work outlined by the staff of the Department of Mechanical Engineering. Prerequisite, graduate standing in mechanical engineering. Research in any field of mechanical engineering as applied mechanics, heat transfer, thermodynamics, heat, power, etc. (Staff.)

MICROBIOLOGY

Professors: Faber, Doetsch, Hansen, Laffer, and Pelczar.

Associate Professor: Hetrick.

Assistant Professors: Cook, MacQuillan, and Roberson.

Lecturer: Stadtman.

The Department of Microbiology offers the degrees of Master of Science and Doctor of Philosophy.

The Department of Microbiology offers a program of advanced courses emphasizing the biological aspects of microorganisms. All candidates for advanced degrees are required to pursue a rigorous program of fundamental and original research in an area approved by the department chairman and the staff.

Further information concerning graduate work in microbiology may be obtained from the Department.

For Graduates and Advanced Undergraduates

Microb. 101. Pathogenic Microbiology. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, $15.00. The role of microorganisms in the diseases of man and animals with emphasis upon the differentiation and culture of microorganisms, type of disease, modes of disease transmission; prophylactic, therapeutic and epidemiological aspects. (Faber.)

MICROB. 103. SEROLOGY. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, Microb. 101. Laboratory fee, $15.00. Infection and resistance: principles and types of immunity; hypersensitiveness. Fundamental techniques of major diagnostic immunilogical reactions and their application.

(Roberson.)

MICROB. 104. HISTORY OF MICROBIOLOGY. (1)

First semester. One lecture period a week. Prerequisite, a major or minor in microbiology. History and integration of the fundamental discoveries of the science. The modern aspects of cytology, taxonomy, fermentation, and immunity in relation to early theories. (Doetsch.)

MICROB. 108. EPIDEMIOLOGY AND PUBLIC HEALTH. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 1. History, characteristic features, and epidemiology of the important communicable diseases; public health administration and responsibilities; vital statistics.

(Faber.)

MICROB. 111. GENERAL VIROLOGY. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Lab fee $15.00. Prerequisite, Microb. 101 or equivalent. Basic concepts regarding the nature of viruses and their properties, together with techniques for their characterization and identification. (Hetrick.)

MICROB. 121. ADVANCED METHODS. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, consent of instructor. Laboratory fee, $15.00. The application of quantitative techniques for the measurement of enzyme reactions, mutations, fermentation analysis and other physiological processes of microorganisms.

(Hansen, Pelczar.)

MICROB. 135. APPLIED MICROBIOLOGY. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, Microb. 1, Chem. 31, and Chem. 33. Laboratory fee. $15.00. Introduction to the chemical activities of microorganisms and their industrial application. (Cook.)

MICROB. 151. MICROBIAL PHYSIOLOGY. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, 8 credits in microbiology and Chem. 31. 33. or equivalent. Laboratory fee, $15.00. Aspects of the growth, death, and energy transactions of microorganisms are considered, as well as the effects of the physical and chemical environment on them. (MacQuillan.)

MICROB. 160. SYSTEMATIC BACTERIOLOGY. (2)

First semester. Two lecture periods a week. Prerequisite, 8 credits in microbiology. History of bacterial classification; international codes of nomenclature; bacterial variation as it affects classification. (Hansen.)

MICROB. 171. CYTOLOGY OF BACTERIA. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, Microb. 1, microbiology major and consent of instructor. Laboratory fee, $15.00. A consideration of morphology, differentiation, and cytochemistry of the eubacterial organism. (Doetsch.)

MICROB. 181. MICROBIOLOGICAL PROBLEMS. (3)

First and second semesters; summer session. Prerequisite, 16 credits in microbiology. Laboratory fee, $15.00. Registration only upon the consent of the instructor. This course is arranged to provide qualified majors in microbiology and majors in allied fields an opportunity to pursue specific microbiological programs under the supervision of a member of the Department. (Faber.)

For Graduates

MICROB. 201. MEDICAL MYCOLOGY. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, 30 credits in microbiology and allied fields. Laboratory fee, $15.00. Primarily a study of the fungi associated with disease and practice in the methods of isolation and identification. (Laffer.)

MICROB. 202. GENETICS OF MICROORGANISMS. (2)

Second semester. Two lecture periods a week. Prerequisite, consent of instructor. An introduction to genetic principles and methodology applicable to microorganisms. Spontaneous and induced mutations, interaction between clones. (Hansen.)

MICROB. 204. BACTERIAL METABOLISM. (2)

First semester. Two lecture periods a week. Prerequisites, 30 credits in microbiology and allied fields, including Chem. 161 and 162. Bacterial nutrition, enzyme formation, metabolic pathways and the dissimilation of carbon and nitrogen substrates. (MacQuillan.)

MICROB. 206, 208. SPECIAL TOPICS. (1-4, 1-4)

First and second semesters. Prerequisite, 20 credits in microbiology. Presentation and discussion of fundamental problems and special subjects in the field of microbiology. (Staff.)

MICROB. 210. VIROLOGY AND TISSUE CULTURE. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 101 or equivalent. Characteristics and general properties of viruses and rickettsiae. Principles of tissue culture. (Hetrick.)

MICROB. 211. VIROLOGY AND TISSUE CULTURE LABORATORY. (2)

Second semester. Two three-hour laboratory periods a week. Prerequisite, Microb. 101 or equivalent. Laboratory fee, $20.00. Registration only upon consent of instructor. Laboratory methods in virology and tissue culture. (Hetrick.)

MICROB. 214. ADVANCED BACTERIAL METABOLISM. (1)

Second semester. One lecture period a week. Prerequisite, Microb. 204 and consent of instructor. A discussion of recent advances in the field of bacterial metabolism with emphasis on metabolic pathways of microorganisms. (Pelczar.)

Microb. 280. Seminar—Research Methods. (1)

First semester. Discussions and reports by majors in microbiology engaged in current research; presentation of selected subjects dealing with recent advances in microbiology. (Staff.)

Microb. 282. Seminar—Microbiological Literature. (1)

Second semester. Presentation and discussion of current literature in microbiology. (Staff.)

Microb. 399. Research.

First and second semesters; summer session. Credits according to work done. Laboratory fee, $15.00. The investigation is outlined in consultation with, and pursued under, the supervision of a senior staff member of the Department. (Staff.)

INSTITUTE FOR MOLECULAR PHYSICS

Professors: Mason, Schamp, and Vanderslice.

Associate Professor: Benesch.

Assistant Professors: DeRocco, Krisher, and Munn.

The Institute for Molecular Physics comprises a faculty interested in theoretical and experimental studies in the general area of molecular interactions. The Institute thus serves as an ideal place to bring together physicists and chemists to work on problems of mutual interest to the advantage of both, and the faculty is made up of members from each of these disciplines. Members of the Institute teach both undergraduate and graduate courses in both the Department of Chemistry and the Department of Physics and Astronomy and supervise thesis research of graduate students in these departments. The department also participates in the graduate degree program in chemical physics which is jointly administered by the Institute, the Department of Chemistry, and the Department of Physics and Astronomy and is described below.

CHEMICAL PHYSICS

This program is open to graduate students in the Departments of Chemistry or Physics and Astronomy and offers a course of study leading to the degrees of Master of Science and Doctor of Philosophy. Entering students are expected to have an undergraduate degree in either chemistry or physics with a strong background in the other discipline. However, a mathematics or engineering major may also be eligible. The following courses must be included in the major: Phys. 212 (4 credits); Chem. 323 (3) or Phys. 210 (3); Chem. 307 (3) or Phys. 208 (3); Phys. 213 (4) or Chem. 321 (3). Major electives may be from the following: Chem. 299 (3);

Chem. 313 (3); Phys. 126 (3); Phys. 216 (2); Phys. 217 (2); Math. 110 (4); Math. 111 (4); Math. 114 (3). Courses to satisfy the minor may be chosen from chemistry, physics, or mathematics. Students with a concentration in chemistry must take one physics course at the 200 level in addition to Phys. 212 and students with a concentration in physics must take a chemistry course at the 200 level in addition to Chem. 187, 189. Research problems in Chemical Physics may be supervised by the faculty in the Department of Chemistry, the Department of Physics and Astronomy or the Institute for Molecular Physics. The program is supervised by a committee from the above units.

Detailed information on this program can be obtained by writing the Chairman of the Chemical Physics Program, Institute for Molecular Physics.

MUSIC

Professors: Ulrich, Grentzer, McCorkle, and Trimble.

Associate Professors: Berman, Dunham, and Johnson.

Assistant Professors: Bernstein, Diemer, Gordon, Head, Heim, and Pennington.

The Department of Music offers the Master of Music degree in four areas of specialization: Music history and literature, theory, composition, and performance; the Doctor of Philosophy degree in two areas: musicology and theory; and the Doctor of Musical Arts degree in two areas: composition and literature-performance. A statement of Departmental requirements supplementing those of the Graduate School has been formulated for each of the areas of specialization. Copies may be obtained by applying to the Department.

For information on work leading to the degrees of Master of Arts, Master of Education, Doctor of Philosophy, or Doctor of Education—all in music education—the student is referred to the section devoted to the Department of Education in this catalogue.

For Graduates and Advanced Undergraduates

Music 112, 113, 152, 153. Applied Music (2, 2, 2, 2)

First and second semesters. Prerequisite, the next lower course on the same instrument. One hour lesson and six practice hours per week. The student will indicate the instrument chosen by adding the proper section number. Special fee of $40.00 per semester. (Staff.)

Music 120, 121. History of Music. (3, 3)

First and second semesters. Prerequisites, Music 1 or 20 and junior standing. A study of musical styles from their origins in western Europe to their present-day manifestations. The interaction of music and other cultural activities. Music 120, the Greek period to Bach; Music 121, Bach to the present. (Bernstein.)

MUSIC 141. MUSICAL FORM. (3)

First semester. Prerequisites. Music 70. 71. A study of the organizing principles of musical composition, their interactions in musical forms, and their functions in different styles. (Meyer.)

MUSIC 143, 144. COMPOSITION. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. The principles of musical composition, and their application to the smaller forms. Original writing in nineteenth- and twentieth-century musical idioms for various media. (Trimble.)

MUSIC 145, 146. COUNTERPOINT. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. A course in eighteenth-century contrapuntal techniques. Study of devices of imitation in the invention and the choral prelude. Original writing in the smaller contrapuntal forms. (Trimble.)

MUSIC 147, 148. ORCHESTRATION. (2, 2)

First and second semesters. Prerequisites, Music 70, 71. A study of the ranges. musical functions and technical characteristics of the instruments. and their color possibilities in various combinations. Practical experience in orchestrating for small and large ensembles. (Trimble.)

MUSIC 150. KEYBOARD HARMONY. (2)

First semester. Prerequisites, Music 70, 71. One lecture and two laboratory hours per week. The application to the piano keyboard of the harmonic principles acquired in Music 70 and 71. Harmonization of melodies, improvising and accompanying, playing from dictation, and transposition. (Haley.)

MUSIC 160, 161. CONDUCTING. (2, 2)

First and second semesters. Music 160 or the equivalent is prerequisite to Music 161. A laboratory course in conducting vocal and instrumental groups. Baton technique, score reading, rehearsal techniques. tone production, style, and interpretation. Music of all periods will be introduced. (Traver.)

MUSIC 164. SOLO VOCAL LITERATURE. (3)

Prerequisite, Music 120, 121 or the equivalent. The study of solo vocal literature from the Baroque cantata to the art song of the present. The Lied, melodie, vocal chamber music, and the orchestral song are examined. (Pennington.)

MUSIC 165. KEYBOARD MUSIC. (3)

Prerequisite, Music 120, 121 or the equivalent. The history and literature of harpsichord, organ, and piano music from the Baroque period to the present. Suites, sonatas, and smaller forms are studied with emphasis on the changes of style and idiom. (Bernstein.)

MUSIC 166. SURVEY OF THE OPERA. (3)

Second semester. Prerequisite, Music 120, 121 or the equivalent. A study of the music, librettos, and composers of the standard operas. (Bernstein.)

MUSIC 167. SYMPHONIC MUSIC. (3)

First semester. Prerequisite, Music 120, 121 or the equivalent. The study of orchestral music from the Baroque period to the present. The concerto, symphony, overture, and other forms are examined. (Tatnall.)

Music 168. Chamber Music. (3)

Second semester. Prerequisite, Music 120, 121 or the equivalent. The history and literature of chamber music from the early Baroque period to the present. Music for trio sonata, string quartet and quintet, and combinations of piano and string instruments is studied. (Ulrich.)

Music 169. Choral Music. (3)

First semester. Prerequisites, Music 120, 121 or the equivalent. The history and literature of choral music from the Renaissance to the present, with discussion of related topics such as Gregorian chant, vocal chamber music, etc. (Bernstein.)

Music 175. Canon and Fugue. (3)

Second semester. Prerequisite, Music 146 or the equivalent. Composition and analysis of the canon and fugue in the styles of the eighteenth, nineteenth, and twentieth centuries. (Trimble.)

Music 180. Acoustics for Musicians. (3)

Second semester. Prerequisites, Music 71 or the equivalent, and senior or graduate standing in music. The basic physics of music, acoustics of musical instruments and music theory, physiological acoustics, and musico-architectural acoustics. (Staff.)

For Graduates

Music 200. Advanced Studies in the History of Music. (3)

First semester. Prerequisites, Music 120, 121, and consent of instructor. A critical study of one style period (Renaissance, Baroque, etc.) will be undertaken. The course may be repeated for credit, since a different period will be chosen each time it is offered. (McCorkle.)

Music 201. Seminar in Music. (3)

Second semester. Prerequisites, Music 120, 121, and consent of instructor. The work of one major composer (Bach, Beethoven, etc.) will be studied. The course may be repeated for credit, since a different composer will be chosen each time it is offered. (McCorkle.)

Music 202. Pro-Seminar in the History and Literature of Music. (3)

Prerequisites, Music 121 and graduate standing. An introduction to graduate study in the history and literature of music. Bibliography and methodology of systematic and historical musicology. (Jordan.)

Music 203. Seminar in Musicology. (3)

Prerequisites, Music 121 and graduate standing. An intensive course in one of the areas of musicology such as performance practices, history of music theory, history of notation, or ethnomusicology. Since a cycle of subjects will be studied, the course may be repeated for credit. (Bernstein, McCorkle.)

Music 204. American Music. (3)

Prerequisites, Music 121 and graduate standing. A lecture course in the history of American art music from Colonial times to the present. (McCorkle.)

Music 206. Advanced Modal Counterpoint. (3)

Prerequisites, Music 146 or the equivalent, and graduate standing. An intensive course in the composition of music in the style of the late Renaissance. Analytical studies of the music of Palestrina, Lasso, Byrd, and others. (Trimble.)

Music 207. The Contemporary Idiom. (3)

Prerequisites, Music 146 or the equivalent, and graduate standing. Composition and analysis in the twentieth century styles, with emphasis on techniques of melody, harmony, and counterpoint. (Trimble.)

Music 208. Advanced Orchestration. (3)

Prerequisites, Music 148 or the equivalent, and graduate standing. Orchestration projects in the styles of Debussy, Ravel, Stravinsky, Schoenberg, Bartok, and others. (Trimble.)

Music 209. Seminar in Musical Composition. (3)

Prerequisites, Music 144 or the equivalent, and graduate standing. An advanced course in musical composition. (Trimble.)

Music 210. Factors in Musical Learning. (3)

Second semester. Prerequisites, Music 121 or the equivalent and at least one course in Psychology. The psychology of intervals, scales, rhythms, and harmony. Musical hearing and creativity. The psychology of musical ability. The theory of functional music. (Staff.)

Music 211. Special Studies in Music. (3)

First and second semesters. Prerequisite, Music 121 or the equivalent. Conference course in problems in music history, literature, and theory. May be repeated for credit. (McCorkle.)

Music 212, 213. Interpretation, Performance, and Analysis of the Standard Repertoire. (2-4 each course.)

Prerequisite, consent of the graduate faculty in the Department. Lab Fee $40.00. A seminar in analysis and interpretation for the graduate performer with advanced instruction at the instrument of the works studied. In Music 213 a seminar paper and a full-length recital are required. (Diemer and Staff.)

Music 215. Aesthetics of Music. (3)

First semester. Prerequisites, Music 121 or the equivalent and one course in Aesthetics. A consideration of the principal theories of aesthetics as they relate to music. A study of writings in the field from Pythagoras to the present. (Staff.)

Music 218. Teaching the Theory, History, and Literature of Music. (3)

Prerequisite, graduate standing and consent of instructor. A course in teaching methodology, with emphasis on instruction at the college level. (Ulrich.)

Music 301, 302. Doctoral Seminar in Music Literature. (3, 3)

First and second semesters. Prerequisites, at least twelve hours in music history and literature. An analytical survey of the literature of music: Section 1, keyboard music; Section 2, vocal music; Section 3, string music; Section 4, wind

instrument music. Required of all candidates for the D.M.A. degree in Literature-Performance. Normally both semesters must be taken before credit is allowed. (Heim and Staff.)

MUSIC 305. DOCTORAL SEMINAR IN MUSIC. (3)

First semester. Prerequisites, at least twelve graduate hours in music history and a familiarity with musicological methods and bibliography. A study of topics in music history and theory based on original research in the subject areas. Required of all candidates for the Ph.D. degree. May be repeated for credit. (McCorkle.)

MUSIC 306. ADVANCED COMPOSITION. (3)

First and second semesters. Prerequisites, Music 209 or the equivalent, and permission of the instructor. Conference course in composition in the larger forms. May be repeated for credit. (Trimble.)

MUSIC 312, 313, 314. INTERPRETATION, PERFORMANCE, AND PEDAGOGY. (4, 4, 4)

Prerequisite, consent of the Graduate music faculty. A seminar in pedagogy and the pedagogical literature for the doctoral performer, with advanced instruction at the instrument, covering appropriate compositions. Required of all candidates for the D.M.A. degree in Literature-Performance. In Music 313 a lecture recital will be required, and in Music 314 a seminar paper and a full-length recital. Special fee of $40.00 for each course. (Staff.)

MUSIC 399. THESIS RESEARCH. (3-6)

Research in theory or history and literature of music, and musical composition. May be repeated for credit. (Staff.)

PHILOSOPHY

Professor: SCHLARETZKI.

Visiting Professor: BRODBECK.

Associate Professor: PASCH.

Visiting Associate Professors: ALEXANDER AND WIEMAN.

Assistant Professors: BROWN AND CELARIER.

Lecturers: GOLDSTONE, KRESS, ROELOFS, AND VARNEDOE.

The Department of Philosophy offers the degrees of Master of Arts and Doctor of Philosophy.

A statement of departmental requirements for these degrees, supplementary to the requirements of the Graduate School, may be obtained on request from the Department.

Courses numbered below 150 will not be accepted for graduate credit in a philosophy major.

For Graduates and Advanced Undergraduates

PHIL. 101. ANCIENT PHILOSOPHY. (3)

First and second semesters. Prerequisite, Philosophy 1 and either one additional course in philosophy or senior standing. A history of Greek thought from its beginnings to the time of Justinian. The chief figures discussed: the Presocratic philosophers, Socrates, Plato, Aristotle, Epicurus, the Stoic philosophers, and Plotinus. (Celarier.)

PHIL. 102. MODERN PHILOSOPHY. (3)

First and second semesters. Prerequisites, Philosophy 1 and either one additional course in philosophy or senior standing. A history of philosophical thought in the West during the 16th, 17th, and 18th centuries. The chief figures discussed: Bacon, Galileo, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and Kant. (Staff.)

PHIL. 103. NINETEENTH CENTURY PHILOSOPHY. (3)

Prerequisites, Phil. 1 and either one additional course in philosophy or senior standing. A survey of philosophy in the nineteenth century through a consideration of such writers as Hegel, Schopenhauer, Nietzsche, Spencer, Marx, Comte, Mill, Mach, and Bradley. (Staff.)

PHIL. 104. TWENTIETH CENTURY PHILOSOPHY. (3)

Prerequisites, Phil. 1 and either one additional course in philosophy or senior standing. A survey of philosophy in the 20th century through a consideration of representative figures in England, Europe, and America. Among the theories to be studied are logical atomism (Russell, Wittgenstein), positivism (Carnap, Ayer), existentialism and phenomenology (Sartre, Husserl), naturalism and realism. (Dewey, Santayana). (Brown.)

PHIL. 105. PHILOSOPHY IN AMERICA. (3)

Prerequisite, Phil. 1. A survey of philosophical thought in America from the eighteenth century to the present. Special attention is given to Edwards, Jefferson, Emerson, Royce, Peirce, James, and Dewey. (Schlaretzki, Varnedoe.)

PHIL. 120. ORIENTAL PHILOSOPHY. (3)

Prerequisite, one course in philosophy. Not offered on College Park campus. An examination of the major philosophical systems of the East, attempting to discover the relations between these and important ideas of Western thought.

PHIL. 123, 124. PHILOSOPHIES MEN LIVE BY. (3, 3)

Not offered on College Park campus. An exploration of the fundamental beliefs which determine what men make of their lives and of the world they live in. Classic statements of these beliefs by great philosophers will be chosen for class discussion on the basis of their significance for the problems confronting modern man.

PHIL. 130. THE CONFLICT OF IDEALS IN WESTERN CIVILIZATION. (3)

A critical and constructive philosophical examination of the assumptions, goals, and methods of contemporary democracy, fascism, socialism, and communism, with special attention to the ideological conflict between the United States and the U.S.S.R. (Staff.)

PHIL. 141. PHILOSOPHY OF LANGUAGE. (3)

Prerequisite, Phil. 41. An inquiry into the nature and function of language and other forms of symbolism. (Kress.)

PHIL. 147. PHILOSOPHY OF ART. (3)

An examination of the fundamental concepts in art and in esthetic experience generally. Readings from the works of artists, estheticians, critics, and philosophers. (Brown.)

PHIL. 151. ETHICAL THEORY. (3)

Prerequisite, Phil. 45. Contemporary problems having to do with the meanings of the principal concepts of ethics and with the nature of moral reasoning. (Roelofs, Schlaretzki.)

PHIL. 152. PHILOSOPHY OF HISTORY. (3)

An examination of the nature of historical knowledge and historical explanation, and of theories of the meaning of world history. (Staff.)

PHIL. 154. POLITICAL AND SOCIAL PHILOSOPHY. (3)

A systematic treatment of the main philosophical issues encountered in the analysis and evaluation of social (especially political) institutions. (Schlaretzki.)

PHIL. 155. SYMBOLIC LOGIC. (3)

Phil. 41 or Math. 3 recommended but not required. An introduction to the concepts and techniques of modern formal logic by means of matrix and axiomatic developments of the sentential calculus and an examination of the first-order predicate calculus in a system of natural deduction. (Pasch.)

PHIL. 156. PHILOSOPHY OF SCIENCE. (3)

Prerequisites, Phil. 41 and either 101 or 102; or consent of instructor. An inquiry into the relations of the sciences, the nature of observation, hypotheses, verification, experiment, measurement, scientific laws and theories, the basic concepts and presuppositions of science, and the relations of science to society. (Staff.)

PHIL. 157. THEORY OF MEANING. (3)

Prerequisites, Phil. 41 and 102. A study of theories about the meaning of linguistic expressions, including the verification theory and the theory of meaning as use. Among topics to be considered are naming, referring, synonymy, intension and extension, and ontological commitment. Such writers as Mill, Frege, Russell, Lewis, Carnap, Wittgenstein, Austin, and Quine will be discussed. (Staff.)

PHIL. 169. TOPICS IN CONTEMPORARY PHILOSOPHY. (3)

Prerequisite, Phil. 102. An intensive examination of contemporary problems and issues. Source material will be selected from recent books and articles. May be repeated for credit when the topics dealt with are different. (Staff.)

PHIL. 170. METAPHYSICS. (3)

First semester. Prerequisites, Phil. 101 and 102. Phil. 41 recommended. A study of some central metaphysical concepts (such as substance, relation, causality, and time) and of the nature of metaphysical thinking. (Pasch.)

PHIL. 171. THEORY OF KNOWLEDGE. (3)

Second semester. Prerequisites, Phil. 101 and 102. Phil. 41 recommended. The origin, nature, and validity of knowledge will be considered in terms of some philosophic problems about perceiving and thinking, knowledge and belief, thought and language, truth and confirmation. (Brown, Pasch.)

PHIL. 175. TOPICS IN SYMBOLIC LOGIC. (3)

Prerequisite, Phil. 155. May be repeated for credit when the topics dealt with are different. (Staff.)

PHIL. 176. INDUCTION AND PROBABILITY. (3)

Prerequisite, consent of instructor. A study of inferential forms, with emphasis on the logical structure underlying such inductive procedures as estimating and hypothesis-testing. Decision-theoretic rules relating to induction will be considered, as well as classic theories of probability and induction. (Staff.)

PHIL. 180. THE PHILOSOPHY OF PLATO. (3)

Prerequisites, Phil. 101 and 102. A critical study of selected dialogues. (Celarier.)

PHIL. 181. THE PHILOSOPHY OF ARISTOTLE. (3)

Prerequisites, Phil. 101 and 102. A critical study of selected portions of Aristotle's writings. (Celarier.)

PHIL. 182. MEDIEVAL PHILOSOPHY. (3)

Prerequisite, Phil. 101 or 102. A history of philosophic thought in the West from the close of the classical period to the Renaissance. Based upon readings in the Stoics, early Christian writers, Neoplatonists, later Christian writers, and Schoolmen. (Celarier.)

PHIL. 184. THE CONTINENTAL RATIONALISTS. (3)

Prerequisites, Phil. 101 and 102. A critical study of the systems of some of the major 17th and 18th century rationalists, with special reference to Descartes, Spinoza, and Leibniz. (Staff.)

PHIL. 185. THE BRITISH EMPIRICISTS. (3)

Prerequisites, Phil. 101 and 102. A critical study of selected writings of Locke, Berkeley, and Hume. (Staff.)

PHIL. 186. THE PHILOSOPHY OF KANT. (3)

Prerequisites, Phil. 101 and 102. A critical study of selected portions of Kant's writings. (Staff.)

PHIL. 190. HONORS SEMINAR. (3)

Open to honors students in philosophy and, by permission of the instructor, to honors students in other departments. Research in selected topics, with group discussion. May be repeated for credit when the topics dealt with are different. (Staff.)

PHIL. 191, 192, 193, 194. TOPICAL INVESTIGATIONS. (1-3)

Each semester. (Staff.)

For Graduates

Phil. 255. Seminar in the History of Philosophy. (3)
Prerequisite, consent of instructor. (Clarier.)

Phil. 256. Seminar in the Problems of Philosophy. (3)
Prerequisite, consent of instructor. (Staff.)

Phil. 260. Seminar in Ethics. (3)
Prerequisite, consent of instructor. (Schlaretzki.)

Phil. 261. Seminar in Esthetics. (3)
Prerequisite, consent of instructor. (Brown.)

Phil. 270. Seminar in Metaphysics. (3)
Prerequisite, consent of instructor. (Pasch.)

Phil. 271. Seminar in the Theory of Knowledge. (3)
Prerequisite, consent of instructor. (Brown.)

Phil. 292. Selected Problems in Philosophy. (1-3)
Each semester. Prerequisite, consent of instructor. (Staff.)

Phil. 399. Research in Philosophy. (1-12)
Each semester. (Staff.)

PHYSICAL EDUCATION, RECREATION AND HEALTH

Professors: Fraley, Harvey, Humphrey, Husman, Johnson, Eyler, and Ho.

Associate Professors: Hanson and Clarke.

Assistant Professors: Kelley and Nessler.

The graduate student majoring in physical education, recreation, or health education may pursue the degrees of Master of Arts, Doctor of Education, and Doctor of Philosophy. The following undergraduate requirements or their equivalents must be met by every candidate before admission to candidacy for a graduate degree in physical education: basic sciences (human anatomy and physiology, physiology of exercise), kinesiology, therapeutics, sport skills, methods, human development, measurement, administration, and student teaching. In the event a student has had successful experience in teaching physical education, the prerequisites of sport skills, methods, and student teaching may be waived. Undergraduate prerequisites in recreation are as follows: psychology, sociology, principles, administration, basic sciences, recreational activities, and practical experience. Undergraduate prerequisites in health educa-

tion: biological sciences, bacteriology, human anatomy and physiology, nutrition, chemistry, psychology, measurement, administration, principles, and field work.

Every student majoring in physical education, health education or recreation is required to take P.E., Hea., Rec. 210—Methods and Techniques of Research, and P.E. 200—Seminar in Physical Education, Recreation, and Health, and P.E. 399—Research—Thesis.

PHYSICAL EDUCATION

For Graduates and Advanced Undergraduates *

P.E. 100. Kinesiology. (4)
First and second semesters; summer session. Three lectures and two laboratory hours a week. Prerequisites, Zool. 1, 14, and 15, or the equivalent.
(Campbell, Nelson.)

P. E. 120. Physical Education for the Elementary School. (3)
First and second semesters; summer session. (Humphrey.)

P. E. 155. Physical Fitness of the Individual. (3)
First and second semesters; summer session. (Staff.)

P.E. 160. Theory of Exercise. (3)
First and second semesters; summer session. Prerequisite, P. E. 100. (Clarke.)

P. E. 170. Supervision in Elementary School Physical Education. (3)
First and second semesters; summer session. Prerequisite, P. E. 120.
(Humphrey.)

P. E. 180. Measurement in Physical Education and Health. (3)
First and second semesters; summer session. Two lectures and two laboratory periods a week. (Kelley, Nessler.)

P. E. 182. History of Dance. (3)
First semester. Prerequisites, P. E. 52, 54, 56, 58, or permission of instructor.
(Madden.)

P. E. 184. Theory and Philosophy of Dance. (3)
First and second semesters. (Madden.)

P. E. 189. Field Laboratory Projects and Workshop. (1-6)
First and second semesters; summer session. (Staff.)

P. E. 190. Administration and Supervision of Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Eyler.)

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*A research project must be conducted in each 100 level course taken for graduate credit.

P. E. 191. The Curriculum in Elementary School Physical Education. (3)
First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 195. Organization and Administration of Elementary School Physical Education. (3)
First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 196. Quantitative Methods. (3)
First and second semesters; summer session. (Hanson.)

For Graduates

P. E. 200. Seminar in Physical Education, Recreation and Health. (1)
First and second semesters; summer session. (Staff.)

P. E. 201. Foundations in Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Eyler.)

P. E. 202. Status and Trends in Elementary School Physical Education. (3)
First and second semesters; summer session. (Humphrey.)

P. E. 203. Supervisory Techniques in Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Pickett.)

P. E. 204. Physical Education and the Development of the Child. (3)
First and second semesters; summer session. Three lectures a week. (Humphrey.)

P. E. 205. Analysis of Contemporary Athletics. (3)
First and second semesters; summer session. (Husman.)

P. E. 210. Methods and Techniques of Research. (3)
First and second semesters; summer session. (Clarke.)

P. E. 215. Principles and Techniques of Evaluation. (3)
First and second semesters; summer session. (Hanson.)

P. E. 230. Source Material Survey. (3)
First and second semesters; summer session. (Eyler.)

P. E. 250. Mental and Emotional Aspects of Sports and Recreation. (3)
First and second semesters; summer session. (Husman.)

P. E. 275. Advanced Analysis of Human Motion. (3)
Prerequisite, P. E. 100; first, second and summer sessions. (Kelley.)

P. E. 280. Scientific Bases of Exercise. (3)
First and second semesters; summer session. (Staff.)

P. E. 287. Advanced Seminar. (1-2)
First and second semesters; summer session. (Staff.)

P. E. 288. Special Problems in Physical Education, Recreation and Health. (1-6)
First and second semester; summer session. (Staff.)

P. E. 290. Administrative Direction of Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Humphrey.)

P. E. 291. Curriculum Construction in Physical Education and Health. (3)
First and second semesters; summer session. (Hanson.)

P. E. 399. Research. (1-5)
First and second semesters; summer session. (Staff.)

HEALTH EDUCATION

For Graduates and Advanced Undergraduates

Hea. 150. Health Problems of Children and Youth. (3)
First and second semesters; summer session. (Johnson.)

Hea. 155. Physical Fitness of the Individual. (3)
First and second semesters; summer session. (Staff.)

Hea. 160. Problems in School Health Education in Elementary and Secondary Schools. (2-6)
First and second semesters; summer session. (Johnson, Staff.)

Hea. 170. The Health Program in the Elementary School. (3)
First and second semesters; summer session. Prerequisites, Hea. 2 and 4, or Hea. 40. (Humphrey.)

Hea. 178. Fundamentals of Sex Education. (3)
First and second semesters; summer session. (Johnson.)

Hea. 180. Measurement in Physical Education and Health. (3)
First and second semesters; summer session. (Kelley, Nessler.)

Hea. 188. Children's Remedial Fitness Clinic. (1-4)
First and second semesters; summer session. (Johnson.)

Hea. 189. Field Laboratory Projects and Workshop. (1-6)
First and second semesters; summer session. (Staff.)

Hea. 190. Administration and Supervision of School Health Education. (3)
First and second semesters; summer session. (Johnson.)

For Graduates

Hea. 200. Seminar in Physical Education, Recreation and Health. (1)
First and second semesters; summer session. (Staff.)

Hea. 203. Supervisory Techniques in Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Pickett.)

Hea. 210. Methods and Techniques of Research. (3)
First and second semesters; summer session. (Clarke.)

Hea. 220. Scientific Foundations of Health Education. (3)
First and second semesters; summer session (Jones.)

Hea. 230. Source Material Survey. (3)
First and second semesters; summer session. (Eyler.)

Hea. 240. Modern Theories of Health. (3)
First and second semesters; summer session. (Jones.)

Hea. 250. Health Problems in Guidance. (3)
First and second semesters; summer session. (Johnson.)

Hea. 260. Public Health Education. (3)
First and second semesters; summer session. (Johnson.)

Hea. 280. Scientific Bases of Exercise. (3)
First and second semesters; summer session. (Staff.)

Hea. 287. Advanced Seminar. (1-2)
First and second semesters; summer session. (Staff.)

Hea. 288. Special Problems in Physical Education, Recreation and Health. (1-6)
First and second semesters; summer session. (Staff.)

Hea. 290. Administrative Direction of Physical Education, Recreation and Health (3)
First and second semesters; summer session. (Humphrey.)

Hea. 291. Curriculum Construction in Physical Education and Health. (3)
First and second semesters; summer session. (Hanson.)

Hea. 399. Research. (1-5)
First and second semesters; summer session. (Staff.)

RECREATION

For Graduates and Advanced Undergraduates

Rec. 120. Program Planning. (3)
First and second semesters. Prerequisite, Rec. 30. (Harvey.)

Rec. 150. Camp Management. (3)
First and second semesters; summer session. (Harvey.)

Rec. 180. Leadership Techniques and Practices. (3)
First and second semesters. (Harvey.)

Rec. S184. Outdoor Education. (6)
Summer only. (Staff.)

Rec. 189. Field Laboratory Projects and Workshops. (1-6)
First and second semesters; summer session. (Staff.)

Rec. 190. Organization and Administration of Recreation. (3)
First and second semesters. (Harvey.)

For Graduates

Rec. 200. Seminar in Physical Education, Recreation and Health. (1)
First and second semesters; summer session. (Staff.)

Rec. 201. Foundations in Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Eyler.)

Rec. 202. Philosophy of Recreation. (2)
First and second semesters; summer session. (Harvey.)

Rec. 203. Supervisory Techniques an Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Pickett.)

Rec. 204. Modern Trends in Recreation. (3)
First and second semesters; summer session. (Harvey.)

Rec. 210. Methods and Techniques of Research. (3)
First and second semesters; summer session. (Clarke.)

Rec. 215. Principles and Techniques of Evaluation. (3)
First and second semesters; summer session. (Hanson.)

Rec. 230. Source Material Survey. (3)
First and second semesters; summer session. (Eyler.)

Rec. 240. Industrial Recreation. (3)
First and second semesters; summer session. (Harvey.)

Rec. 260. Hospital Recreation. (3)
First and second semesters; summer session. (Harvey.)

Rec. 287. Advanced Seminar. (1-2)
First and second semesters; summer session. (Staff.)

Rec. 288. Special Problems in Physical Education, Recreation and Health. (1-6)
First and second semesters; summer session. (Staff.)

Rec. 290. Administrative Direction of Physical Education, Recreation and Health. (3)
First and second semesters; summer session. (Humphrey.)

Rec. 399. Research. (1-5)
First and second semesters; summer session. (Staff.)

PHYSICS AND ASTRONOMY

(For Astronomy and Institute for Molecular Physics [Chemical Physics], see Table of Contents)

Professors: LASTER, DAY, ESTABROOK, FERRELL, GRIEM, HOLMGREN, HORNYAK, MACDONALD, MARION, MYERS, SNOW, STERN, SUCHER, WEBER, WESTERHOUT, AND YODH.

Professors (part-time): BURGERS,* FRIEDMAN, HAYWARD, MCDONALD, MONTROLL,* MUSEN, RADO, AND SLAWSKY.

Research Professors: MASON,** ÖPIK, PAI,* TIDMAN,* SCHAMP,** VANDERSLICE,** AND WESKE.*

Visiting Professors: BANERJEE, EDEN, AND HORIE.

Visiting Professor (part-time): ESCOBAR-V.

Associate Professors: ALLEY, DETENBECK, EARL, ERICKSON, FALK, GLASSER,[1] GLOVER, GREENBERG, MISNER, ONEDA, PRANGE, PUGH, REISER,[2] SMITH, STEINBERG, VAN WIJK, WALL, ZIPOY, AND G. ZORN.

Associate Research Professors: BENESCH,** FALLER* AND WILKERSON.*

Associate Professors (part-time): BENNETT AND J. R. DIXON.

Visiting Associate Professors: EBERHAGEN AND KOMESAROFF.

Assistant Professors: ANDERSON, BARDASIS, BEALL, BELL, BETTINGER, BHAGAT, BLOCK, CONDON, DESILVA, DILAVORE,[3] DORFMAN,[4] DRAGT, FIVEL, GLICK, GREIG, KACSER, KEHOE, KIM, KOCH, LAPOINTE, LEIBOWITZ, LENCHEK, PATI, WHATLEY, WOO, WOODS, AND ZAPOLSKY.

Assistant Research Professors: CHARATIS,* DEROCCO,** GUERNSEY,* KOOPMAN,* KRISHER,** LASHINSKY* AND B. S. ZORN.

Visiting Assistant Professors: GUSS AND YOUNG.

Research Associates: BERES, BURN, CARMELI, CLEM, CONNERS, W. G. DIXON, HINDS, KEPPLE, KORENMANN, KUNZE, LINCKE, MEAD, PEACH, POULTNEY, RABINOVITCH, RESNIKOFF, RUHL, RICHARD, SAIEDY, SINCLAIR, SKADRON, SCHMIDT, WHITE AND WILLOTT.

Visiting Lecturers: BRUNSTEIN, CHOU, FICHTEL, GUTSCHE AND HAGGE.

Part-time Lecturers: AITKEN, ALTMAN, BLEIL, COYNE, DONNERT, HOWARD, IVORY, KARLE, KOSTKOWSKI, LIDE, MAISCH, MAYCOCK, MCNELIS, REISS, SAENZ, SIMONS, WADA, WARNER AND WOLCOTT.

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* Institute for Fluid Dynamics and Applied Mathematics.
** Institute of Molecular Physics.
[1] Joint Appointment with Computer Science Center.
[2] Joint Appointment with Electrical Engineering.
[3] Joint Appointment with College of Education.
[4] Joint Appointment with Institute for Fluid Dynamics and Applied Mathematics.

PHYSICS

It is expected that the following areas should have been studied preliminary to graduate work. Any deficiencies should be made up at once. A limited amount of graduate credit will be allowed for courses so taken.

General Physics	Electricity and Magnetism
Thermodynamics	Modern Physics
Intermediate Mechanics	Advanced Calculus
Physical Optics	Vector Analysis

Candidates for both the master's and doctor's degrees are required to take Theoretical Dynamics (Physics 200, 201) and Electrodynamics (Physics 204, 205). These courses each run for a full year and carry a total of 12 semester hours credit.

Candidates for the doctor's degree, likewise should take Theoretical Dynamics, (Phys. 200, 201,) Electrodynamics, (Phys. 204, 205) and Quantum Mechanics (Phys. 212, 213). No other courses are specifically required for students doing experimental thesis research, but Advanced Quantum Mechanics (Phys. 254) is required for students doing dissertations in theoretical physics. It is recommended in the selection of further courses that the student avoid overspecialization in any field. In particular, he should take a wide variety of classical courses as well as courses in selected fields of modern physics. A few of the advanced courses are given only every second or third year; the student should check with the Department to confirm when a given course is available.

Candidates for advanced degrees in physics may have a minor in either astronomy, chemistry, chemical physics, mathematics, engineering, and/or in those fields of physics other than general physics and their field of major specialization.

There is also a graduate program in Chemical Physics centered in the Institute of Molecular Physics, with degrees either in Physics or Chemistry Departments. See description on p. 211.

Thesis (Ph.D.)

The student must submit an outline of his topic to the graduate faculty for approval. This outline must clearly set forth the nature of the problem, proposed method of procedure and the possible results that may be obtained. The completed thesis will also be presented to the graduate faculty for approval.

Time Limits

There is a departmental limit on the time taken to get a graduate degree in physics or astronomy. For the M.S., this is five calendar years from the date of first enrolling in the Graduate School for full-time students and six years for part-time students. For the Ph.D., the time limit is seven years from the date of first enrolling in the Graduate School for full-time students and eight years for part-time students.

Graduate Assistants and other students whose employment is part-time and secondary to their studies are considered full-time students. Timing began on September 12, 1960 for those students who were enrolled in the Graduate School before that date.

Off-Campus Courses

The Department of Physics and Astronomy offers courses at convenient times and places so as to accommodate the greatest number of students. In order to facilitate graduate study in the Washington area, the Department has part-time professors in certain government laboratories where a large number of students are interested in graduate study. All M.S. candidates beginning graduate studies after August, 1960, must take at least 3 credits of their graduate work on the College Park campus. All students who began graduate work in the University of Maryland courses after August, 1960, will be required to complete on the College Park campus at least 18 credits of their graduate work for the Ph.D. degree in physics: these credits must include at least 2 credits of Phys. 230—Seminar, and the remainder can be divided among major and minor physics courses and thesis research. Normally, students will complete a much greater proportion of their graduate study on the College Park campus. At government agencies where there is no part-time professor, employees desiring to do graduate work in physics should contact a member of the graduate staff in the Department.

Because of the large number of qualified applicants, the Department of Physics and Astronomy has had to restrict formal admission to the Graduate School to those who have shown particularly outstanding work in their undergraduate records or who have already done satisfactory work in key 100-level courses at Maryland. Those students who are initially refused formal admission to the Graduate School may apply for admission to University College (off-campus program), or to the College of Arts and Sciences as special students. Each such student should then take at least 12 credits of 100-level courses in physics and astronomy including, if possible, Physics 120 and Physics 122 or other comparable courses suggested by his advisor. At the completion of all of these courses with grades of "B" or better, the student should then reapply for admission to the Graduate School. While the credits earned in University College are not directly applicable toward a graduate degree, the student will find that the credit requirements are normally not the principal obstacle anyway in earning an advanced degree and the courses taken by registration in University College will form a good basis for later graduate study. The University of Maryland hopes in this way to offer an opportunity for advanced study in physics and astronomy to all qualified students.

Further Information

For more information, students should write the Department of Physics

and Astronomy for the departmental publication entitled "Graduate Study in Physics."

GENERAL PHYSICS

For Graduates and Advanced Undergraduates

Phys. 100. Advanced Experiments. (2 credits per semester)

Four hours of laboratory work per week. Prerequisite, four credits of Phys. 60 or consent of instructor. Laboratory fee, $10.00 per semester. Selected fundamental experiments in electricity and magnetism, elementary electronics, and optics. (Glover, E. Stern.)

Phys. 102. Optics. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21. It is suggested, but not required, that Phys. 60 or Phys. 100 be taken concurrently with this course. Geometrical optics, optical instruments, wave motion, interference and diffraction, and other phenomena in physical optics. (Zipoy.)

Phys. 103. Applied Optics. (3)

Three lectures a week. Prerequisite, Phys. 102. A detailed study of physical optics and its application. (Alley.)

Phys. 104, 105. Electricity and Magnetism. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21; Electrostatics, direct current and alternating current circuitry, electromagnetic effects of steady currents, electromagnetic induction, radiation, development of Maxwell's equations, Poynting vector, wave equations, and electronics. (Steinberg.)

Phys. 106, 107. Theoretical Mechanics. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, Phys. 51 or consent of instructor. A detailed study of Newtonian mechanics. Dynamics, the motion of rigid bodies, oscillation problems, etc., are studied. Lagrange's equation of the first kind and the Hamilton-Jacobi equation are introduced. (Guss.)

Phys. 109. Electronic Circuits. (4)

Second semester. Three hours of lecture and two of laboratory per week. Prerequisite, Phys. 100 and 105 or concurrent enrollment in or Phys. 128. Theory of semi-conductor and vacuum tube circuits. Application in experimental physics. Laboratory fee, $10.00. (Condon.)

Phys. 110. Special Laboratory Projects in Physics. (1, 2, or 3)

Two hours laboratory work a week for each credit hour. One to three credits may be taken concurrently, each semester. Prerequisite, Phys. 100 and consent of adviser. Laboratory fee, $10.00 per credit hour. Selected advanced experiments. (Staff.)

Phys. 111. Physics Shop Techniques. (1)

First semester. One three-hour laboratory per week. Prerequisite, Phys. 100 or consent of instructor. Laboratory fee, $10.00. Machine tools, design and construction of laboratory equipment. (Horn.)

PHYS. 114, 115. INTRODUCTION TO BIOPHYSICS. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, intermediate physics and Math. 21. A study of the physical principles involved in biological processes, with particular emphasis on current research in biophysics. (Mullins.)

PHYS. 118. INTRODUCTION TO MODERN PHYSICS. (3)

Each semester. Three lectures a week. Prerequisites, general physics and integral calculus, with some knowledge of differential equations and a degree of maturity as evidenced by having taken one or more of the courses Phys. 50 through Phys. 110. Introductory discussion of special relativity, origin of quantum theory, Bohr atom, wave mechanics, atomic structure, and optical spectra. (Zorn.)

PHYS. 119. MODERN PHYSICS. (3)

Each semester. Three lectures a week. Prerequisite, Phys. 118. A survey of nuclear physics, x-rays, radioactivity, wave mechanics, and cosmic radiation. (Woo.)

PHYS. 127, 128. ELEMENTS OF MATHEMATICAL PHYSICS. (4, 4)

First and second semesters. Prerequisite, Physics 18 and Mathematics 21, or consent of the instructor. Classical dynamics and electrodynamic waves. A careful study of mathematical approaches used in mechanics, electricity and magnetism, and physical optics. (Marion.)

PHYS. 130, 131. BASIC CONCEPTS OF PHYSICS. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, junior standing. Lecture demonstration fee, $2.00 per semester. A primarily descriptive course intended mainly for those students in the liberal arts who have not had any other course in physics. This course does not satisfy the requirements of professional schools nor serve as a prerequisite or substitute for other physics courses. The main emphasis in the course will be on the concepts of physics, their evolution and their relation to other branches of human endeavor. (Gutsche.)

PHYS. 140, 141. ATOMIC AND NUCLEAR PHYSICS LABORATORY. (3, 3)

First and second semesters. One lecture and four hours of laboratory a week. Laboratory fee, $10.00 per semester. Prerequisites, two credits of Phys. 100 and consent of instructor. Classical experiments in atomic physics and more sophisticated experiments in current techniques in nuclear physics. Enrollment is limited to ten students. (Holmgren, Earl.)

PHYS. 144, 145. METHODS OF THEORETICAL PHYSICS. (4, 4)

First and second semesters. Prerequisite, Physics 128. A survey of basic ideas in thermodynamics and statistical mechanics. An introduction to electrodynamics, quantum mechanics, and relativity. Primary emphasis will be placed upon the mathematical methods involved in our understanding of these topics. (Griem.)

PHYS. 152. INTRODUCTION TO THERMODYNAMICS AND STATISTICAL MECHANICS. (3)

Three lectures a week. Prerequisites. Mathematics 21, Physics 18 or 51, or consent of the instructor. Introduction to basic concepts in thermodynamics and statistical mechanics. (Dorfman.)

PHYS. 153. MODERN PHYSICS FOR ENGINEERS. (3)

Each semester. Three lectures per week. Prerequisites, Physics 18 or 21 and Math. 22. A survey of atomic and nuclear phenomena and the main trends in modern physics. This course is designed for students who are not physics majors (Mathematics, chemistry, engineering). (Pugh, Detenbeck.)

A. GENERAL

Of the courses which follow, 200, 201, 204, 205, 212, 213, 234, 235, 252, 253, 254, 255 and 258 are given every year; all others will be given according to demand.

For Graduates

PHYS. 200, 201. THEORETICAL DYNAMICS. (3, 3)

Each semester. Three lecture hours per week. Prerequisite, Physics 127 or equivalent. This basic course for graduate study in physics covers advanced classical mechanics, hydrodynamics, elasticity, thermodynamics, and statistical mechanics. It is normally taken concurrently with Physics 204, 205. (Myers, Glick, Misner.)

PHYS. 202, 203. ADVANCED DYNAMICS. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Phys. 201. A detailed study of advanced classical mechanics. (Myers.)

PHYS. 204, 205. ELECTRODYNAMICS. (3, 3)

First and second semesters. Three lecture hours per week. Prerequisite, Physics 128 or equivalent. This basic course for graduate study in physics covers electrodynamics and relativity. It is normally taken concurrently with Phys. 200, 201. (Sucher, Zopoy.)

PHYS. 208. THERMODYNAMICS. (3)

Three lectures per week. Prerequisite, Phys. 201. The first and second laws of thermodynamics are examined and applied to homogeneous and non-homogeneous systems, calculations of properties of matter, the derivation of equilibrium conditions and phase transitions, the theory of irreversible processes. (Mason.)

PHYS. 212, 213. INTRODUCTION TO QUANTUM MECHANICS. (4, 4)

First and second semesters. Four lectures per week. Prerequisite, Phys. 201 or an outstanding undergraduate background in physics. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc., and applications to solid state, atomic, and nuclear physics. (Weber, Falk, Zapolsky.)

PHYS. 222, 223. BOUNDARY-VALUE PROBLEMS OF THEORETICAL PHYSICS. (2, 2)

Prerequisite, Phys. 205. (Falk.)

PHYS. 228. SYMMETRY PROBLEMS IN PHYSICS. (3)

Three lectures per week. Prerequisite, Physics 213. A study of general methods of classification of physical systems by their symmetries and invariance properties, especially in quantum field theory applications. (Misner, Pati.)

PHYS. 240, 241. THEORY OF SOUND AND VIBRATIONS. (3, 3)
Three lectures a week. Prerequisite, Phys. 201. A detailed study of acoustics and the theory of vibrations.

B. ATOMIC AND MOLECULAR PHYSICS

For Graduates and Advanced Undergraduates

PHYS. 126. KINETIC THEORY OF GASES. (3)
Three lectures a week. Prerequisites, Phys. 107 and Math. 21. Dynamics of gas particles, Maxwell-Boltzmann distribution, diffusion, Brownian motion, etc. (Mason.)

For Graduates

PHYS. 210. STATISTICAL MECHANICS. (3)
Three lectures a week. Prerequisites, Phys. 119. and Phys. 201. A study of the determination of microscopic behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications of solid state physics and the study of gases. (Montroll, Dorfman.)

PHYS. 214. THEORY OF ATOMIC SPECTRA. (3)
Three lectures a week. Prerequisite, Phys. 213. A study of atomic spectra and structure—one and two electron spectra, fine and hyper-fine structure, line strengths, line widths, etc. (Wilkerson.)

PHYS. 215. THEORY OF MOLECULAR SPECTRA. (3)
Three lectures a week. Prerequisite. Phys. 214. The structure and properties of molecules as revealed by rotational, vibrational, and electronic spectra. (Vanderslice.)

PHYS. 216, 217. MOLECULAR PHYSICS. (2, 2)
Two lectures a week. Prerequisites. Phys. 213. Molecular theory of gases and liquids. ensemble theory, analysis of empirical models for molecular interactions, theory of Coulomb interactions between charge distributions. (Mason.)

C. SOLID STATE PHYSICS

For Graduates and Advanced Undergraduates

PHYS. 122. PROPERTIES OF MATTER. (4)
Each semester. Four lectures a week. Prerequisite, Phys. 119 or equivalent. Introduction to solid state physics. Electromagnetic, thermal, and elastic properties of metals, semiconductors and insulators. (Anderson, Glover, Stern.)

For Graduates

PHYS. 218, 219. X-RAYS AND CRYSTAL STRUCTURE. (3, 3)
Three lectures per week. Prerequisite, Phys. 205. A detailed study of crystal structure of solids and of x-rays. (Stern.)

Phys. 220. Application of X-Ray and Electron Diffraction Methods. (2)

Two laboratory periods a week. Prerequisite, concurrent enrollment in Phys. 218. The investigation of crystal structure, using x-rays and electron diffraction. (Stern.)

Phys. 242, 243. Theory of Solids. (3, 3)

First and second semesters. Two lectures a week. Prerequisite, Phys. 213. Properties of metals, lattice vibrations and specific heats; Boltzmann, Fermi-Dirac, and Bose-Einstein statistics, free electron gas theories, band theory of metals. (Prange.)

D. NUCLEAR PHYSICS

For Graduates and Advanced Undergraduates

Phys. 120. Nuclear Physics. (4)

Each semester. Four lecture hours a week. Prerequisite, Physics 119. An introduction to nuclear physics at the pre-quantum mechanics level. Properties of nuclei; radioactivity; nuclear systematics; nuclear moments; the shell model; interaction of charged particles and gamma-rays with matter; nuclear detectors; accelerators; nuclear reactions; beta decay; high energy phenomena. (Young, Holmgren.)

For Graduates

Phys. 234, 235. Theoretical Nuclear Physics. (3, 3)

Three lectures a week. Prerequisites, Phys. 120 and Phys. 213. Nuclear properties and reactions, nuclear forces, two, three, and four body problems, nuclear spectroscopy, beta decay, and related topics. (MacDonald.)

Phys. 252, 253. Nuclear Structure Physics. (3, 3)

First and second semesters. Three lecture hours per week. Prerequisite, Phys. 120 or equivalent; co-requisite, Phys. 212-213 or consent of instructor. Nuclear structure and nuclear reactions. Two-body scatterings; nucleon-nucleon forces and the deuteron. Neutron scattering; the optical model. Resonance reactions, phase-shift analysis, positions and properties of energy levels; the shell model. Direct reactions. Electromagnetic transitions. Photoreactions. The design of experiments; the extraction of parameters from experimental data and the comparison with nuclear models. (Pugh, Holmgren.)

E. ELEMENTARY PARTICLE PHYSICS

Phys. 239. Elementary Particles. (3)

Three lectures a week. Prerequisite, Phys. 237. Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory. (Sucher, Day, Oneda.)

Phys. 254. Advanced Quantum Mechanics. (3)

Each semester. Prerequisite, Physics 213. Relativistic wave equations, second quantization in many body problems and relativistic wave equations, Feynman-Dyson perturbation theory, applications to many body problems, applications to quantum electrodynamics, elements of renormalization. (Ferrell, Kim.)

PHYS. 255. ADVANCED QUANTUM MECHANICS. (3)

Second semester. Prerequisite, Physics 254. Renormalizations of Lagrangian Field Theories, Lamb Shift, Positronium fine structure, T. C. P. invariance, connection between spin and statistics, broken symmetries in many body problems, soluble models, analyticity in perturbation theory, simple applications of dispersion relations. (Kim.)

PHYS. 257 THEORETICAL METHODS IN ELEMENTABY PARTICLE PHYSICS. (3)

First semester. Co-requisite, Physics 255. (Sucher, Oneda.)

PHYS. 258 QUANTUM FIELD THEORY. (3)

Second semester. Co-requisite, Physics 255.
Introduction to Hilbert space, general postulates of relativistic quantum field theory, asymptotic conditions, examples of local field theory, Jost-Lehmann-Dyson representation and applications, generalized free field theory, general results of local field theory—TCP theorem, spin statistics connections, Borchers' theorems, Reeh-Schlieder theorem. (Greenberg, Oneda.)

PHYS. 260. HIGH ENERGY PHYSICS. (3)

Three lectures a week. Co-requisite, Phys. 254 or consent of instructor. Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments. (Oneda, Snow.)

F. ASTROPHYSICS AND GEOPHYSICS

For additional courses, see the section on Astronomy, below.

For Graduates and Advanced Undergraduates

PHYS. 123. INTRODUCTION TO ATMOSPHERIC AND SPACE PHYSICS. (3)

Three lectures a week. Prerequisite, Physics 127 and Physics 118 or consent of instructor. Motions of charged particles in magnetic fields, aspects of plasma physics related to cosmic rays and radiation belts, atomic phenomena in the atmosphere, thermodynamics and dynamics of the atmosphere.
(Lenchek, Bettinger.)

For Graduates

PHYS. 221. UPPER ATMOSPHERE AND COSMIC RAY PHYSICS. (2)

Two lectures a week. Prerequisite, Phys. 201 or consent of instructor. Structure of the atmosphere, rocket and satellite experiments, primary and secondary cosmic rays, origins of cosmic rays, geomagnetic theory.
(Lenchek, Laster.)

G. PLASMA PHYSICS AND FLUID DYNAMICS

For Graduates and Advanced Undergraduates

PHYS. 116, 117. INTRODUCTION TO FLUID DYNAMICS. (3, 3)

Three lectures a week. Prerequisites, Phys. 106 and Math. 21. Kinematics of fluid flow, properties of incompressible fluids, complex variable methods of analysis, wave motions. (Koopmann.)

For Graduates

PHYS. 206. KINETIC THEORY OF PLASMAS. (3)
Three hours of lecture per week. Prerequisite, Physics 204, 205. Knowledge of complex variable theory is also desirable. A detailed study of plasma physics. (Tidman.)

PHYS. 207. PLASMA PHYSICS. (3)
Prerequisite, Phys. 204, 205, orbit theory, transport processes, radiation, waves, stability theory. (Griem.)

PHYS. 224, 225. SUPERSONIC AERODYNAMICS AND COMPRESSIBLE FLOW. (2, 2)
Two lectures a week. Prerequisite, Phys. 201. (Pai.)

PHYS. 226, 227. THEORETICAL HYDRODYNAMICS. (3, 3)
Three lectures a week. Prerequisite, Phys. 201. A detailed study of advanced fluid dynamics. (Burgers.)

PHYS. 232, 233. HYDROMECHANICS SEMINAR. (1, 1)
First and second semesters. One meeting a week. (Staff.)

PHYS. 246, 247. SPECIAL TOPICS IN FLUID DYNAMICS. (2, 2)
Prerequisites, advanced graduate standing and consent of the instructor. (Burgers.)

PHYS. 262, 263. AEROPHYSICS. (3, 3)
Three lectures. Prerequisite, consent of the instructor. (Pai.)

H. GENERAL RELATIVITY

PHYS. 236. THEORY OF RELATIVITY. (3)
Three lectures a week. Prerequisite, Phys. 201. A study of Einstein's special theory of relativity and some consequences, and a brief survey of the foundations of general relativity. (Weber, Misner.)

I. RESEARCH, SEMINARS AND SPECIAL TOPICS

For Graduates and Advanced Undergraduates

PHYS. 150. SPECIAL PROBLEMS IN PHYSICS.
Research or special study. Credit according to work done. Laboratory fee, $10.00 per credit hour when appropriate. Given each semester. Prerequisite. major in physics and consent of adviser. (Staff.)

PHYS. 190. INDEPENDENT STUDIES SEMINAR. (Credit according to work done.)
First and second semesters. Enrollment is limited to students admitted to the Undergraduate Honors Program in physics. (Staff.)

For Graduates

PHYS. 230. SEMINAR.

Seminars on various topics in advanced physics are held each semester, with the contents varied each year. One credit for each seminar each semester. (Staff.)

PHYS. 231. APPLIED PHYSICS SEMINAR.

One credit for each semester. (Staff.)

PHYS. 238. QUANTUM THEORY—SELECTED TOPICS. (3)

Three lectures a week. Prerequisite, Phys. 213. (Staff.)

PHYS. 245. SPECIAL TOPICS IN APPLIED PHYSICS.

Two credits each semester. Two lectures a week. (Staff.)

PHYS. 248, 249. SPECIAL TOPICS IN MODERN PHYSICS. (2, 2)

Two lectures a week. Prerequisites, calculus and consent of instructor. (Staff.)

PHYS. 399. RESEARCH.

Credit according to work done, each semester. Laboratory fee, $10.00 per credit hour. Prerequisite: an approved application for admission to candidacy or special permission of the Department. (Staff.)

J. SPECIAL PHYSICS COURSES FOR HIGH SCHOOL SCIENCE TEACHERS

The courses in this section were especially designed for high school teachers and are not applicable to B.S., M.S., or Ph.D. degrees in physics without special permission of the Department. However, these courses can be included as part of a physics minor or as electives. No prerequisites are required.

PHYS. 118A. ATOMS, NUCLEI, AND STARS. (3)

Three lectures per week. An introduction to basic ideas of the constitution and properties of atomic and subatomic systems and of the overall structure of the universe. (Hornyak.)

PHYS. 112A. PROPERTIES OF MATERIALS. (3)

Three lectures per week. An introduction to the study of solid state physics and the properties of fluids. (E. Stern.)

PHYS. 160A. PHYSICS PROBLEMS. (1, 2, 3)

Lectures and discussion sessions arranged. (Laster.)

PHYS. 170A. APPLIED PHYSICS. (3)

Three lectures per week. (Hornyak.)

PHYS. 199. NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTE FOR TEACHERS OF SCIENCE AND MATHEMATICS SEMINAR. (1)

Arranged during summer school. Enrollment limited to participants in the N.S.F. Summer Institute. Laboratory fee, $5.00. (Detenbeck, Staff.)

POULTRY SCIENCE

Professors: Shaffner and Combs.

Research Professor: Shorb.

Associate Professors: Creek, Helbacka and Wilcox.

Course work and research leading to the Master of Science and the Doctor of Philosophy degrees are offered. The student may pursue work with the major emphasis either in nutrition, physiology, physiological genetics, or the technology of eggs and poultry.

Department requirements, supplementary to the Graduate School, have been formulated for the guidance of candidates for graduate degrees. Copies of these requirements may be obtained from the Department of Poultry Husbandry.

For Graduates and Advanced Undergraduates

An. Sci. 160. Technology of Market Eggs and Poultry. (3)
First semester. Two lectures and one laboratory per week. A study of the technological factors concerned with the processing, storage, and marketing of eggs and poultry, also factors affecting their quality and grading. (Helbacka)

A. E. 117. Economics of Marketing Eggs and Poultry. (3)
Second semester. Three lectures per week. (See Agricultural Economics A. E. 117.) (Staff.)

Poultry Hygiene, see Animal Science, 170. (3) (DeVolt.)

Avian Anatomy, see Animal Science, 171. (3) (DeVolt.)

An. Sci. 109. Fundamentals of Nutrition. (3)
Second semester. Three lectures per week. Prerequisites, Chem. 31 and 33. A study of the fundamental role of all nutrients in the body including digestion, absorption, and metabolism. Dietary requirements and nutritional deficiency syndromes of laboratory and farm animals and man will be considered. This course will be for both graduate and undergraduate credit with additional assignments given to the graduate students. (Combs.)

An. Sci. 161. Poultry Genetics. (3)
Two lectures and one laboratory period per week. Prerequisites, An. Sc. and Zool. 6. Inheritance of factors related to egg and meat production and quality are stressed. An experiment utilizing procedures of pedigreed matings will be performed in the laboratory. (Wilcox.)

An. Sci. 162. Avian Physiology. (2)

First semester. One lecture and one laboratory period per week. Prerequisites, Zool. 1 and Zool. 102 or equivalent. The basic physiology of the bird is discussed, excluding the reproductive system. Special emphasis is given to physiological differences between birds and other vertebrates. (Wilcox.)

An. Sci. S163. Poultry Breeding and Feeding. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and extension service workers. The first half will be devoted to problems concerning breeding and the development of breeding stock. The second half will be devoted to nutrition. (Combs, Wilcox.)

An. Sci. S164. Poultry Products and Marketing. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and county agents. It deals with the factors affecting the quality of poultry products and with hatchery management problems, egg and poultry grading, preservation problems and market outlets for Maryland poultry. (Helbacka.)

For Graduates

An. Sci. 221. Energy and Protein Nutrition. (3)

See An. Sci. for description. (Leffel, Combs.)

An. Sci. 240. Ruminant Nutrition. (2)

See Dairy Sci. for description. (Vondersoll.)

An. Sci. 261. Physiology of Reproduction. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Zool. 102 or its equivalent. The role of the endocrines in reproduction is considered. Fertility, sexual maturity, egg formation, ovulation, and the physiology of oviposition are studied. Comparative processes in birds and mammals are discussed. (Shaffner.)

An. Sci. 262. Poultry Literature. (1-4)

First and second semesters. Readings on individual topics are assigned. Written reports required. Methods of analysis and presentation of scientific material are discussed. (Staff.)

An. Sci. 263S. Poultry Nutrition Laboratory. (2)

One lecture and one laboratory period a week. To acquaint graduate students with common basic nutrition research techniques useful in conducting experiments with poultry. Actual feeding trials with chicks as well as bacteriological and chemical assays will be performed. (Creek.)

An. Sci. 264. Vitamins. (2)

First semester. One lecture and one laboratory per week. Prerequisites, An. Sci. 109, Chem. 31, 33, and 161. Advance study of the fundamental role of vitamins in nutrition including chemical properties, absorption, metabolism, storage, excretion and deficiency syndromes. A critical study of the biochemical basis of vitamin function, interrelationships of vitamins with other substances and of certain special laboratory techniques. (Combs.)

An. Sci. 265. Mineral Metabolism. (2)

Second semester. Two lectures per week. Prerequisites, Chem. 161 and 163. The role of minerals in metabolism of animals and man. Topics to be covered include the role of minerals in energy metabolism, bone structure, elcctrolyte balance, and as catalysts. (Creek.)

An. Sci. 301. Special Problems in Animal Science. (1-2 cr. 4-cr. max.)

First and second semesters. Prerequisite, approval of staff. Work assigned in proportion to amount of credit. Problems will be assigned which relate specifically to the character of work the student is pursuing. (Staff.)

An. Sci. 302. Seminar. (1)

First and second semesters. Students are required to prepare papers based upon current scientific publications, relating to animal science or upon their research work for presentation before and discussed by the class. (Staff.)

An. Sci. 399. Research. (1-12)

First and second semester. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of animal science, carrying some to completion and report the results in the form of a thesis. (Staff.)

PSYCHOLOGY

Professors: Andrews, Battig, Daston, McGinnies, and Waldrop.

Part-time Professors: Brady and Edgerton.

Associate Professors: Anderson, Bartlett, Gollub, Leventhal, Maxwell, Pumroy, Walder, and Yarczower.

Assistant Professors: Fisher, Fretz, Golann, Higgs, Johnson, McIntire, McKenzie, O'Brien, Pavey, Steinman, Turnage, and Ward.

For the master's degree a minimum of 30 hours are required. The *major*, composed of 21 hours, will be identified as *General Psychology* and will consist of Psych. 211-212 (6), Psych. 252-253 (6), the master's thesis research (6), and one elective course (3). The *minor*, composed of a minimum of 9 hours, will ordinarily be taken in a field of specialization which the student proposes for the major in his doctoral program.

For the doctoral degree a minimum of 72 hours is required. The *majors*, composed of 48 hours, will consist of at least 30 hours in courses chosen from two specialized fields, and 18 hours of research for thesis, the last including 6 hours for the master's thesis. The *minor* will be in *General Psychology* and will consist of a total of 24 hours including Psych. 205-206 (6), Psych. 211-212 (6), Psych. 252-253 (6), and two elective courses (6).

For Graduates and Advanced Undergraduates

Graduate credit will be assigned only for students certified by the Department of Psychology as qualified for graduate standing.

PSYCH. 110. EDUCATIONAL PSYCHOLOGY. (3)

Second semester. Prerequisite, Psych. 1. Researches on fundamental psychological problems encountered in education. Measurement and significance of individual differences; learning, motivation, transfer of training, and the educational implications of theories of intelligence. (Maxwell.)

PSYCH. 122. ADVANCED SOCIAL PSYCHOLOGY. (3)

Second semester. Prerequisites, Psych. 21, and Psych. 90 or consent of instructor. A systematic review of researches and points of view in regard to major problems in the field of social psychology. (McGinnies, Higgs, Ward.)

PSYCH. 123. LANGUAGE AND SOCIAL COMMUNICATION. (3)

Second semester. Prerequisite, Psych. 21, senior standing and consent of instructor. The nature and significance of verbal and non-verbal communication in social psychological processes, including examination of relevant theoretical approaches to symbolic behavior. (McGinnies, Higgs, Ward.)

PSYCH. 131. ABNORMAL PSYCHOLOGY. (3)

First and second semesters. Prerequisite, 3 courses in psychology including Psych. 5. The nature, diagnosis, etiology, and treatment of mental disorders. (Staff.)

PSYCH. 136. APPLIED EXPERIMENTAL PSYCHOLOGY. (3)

Second semester. Prerequisite, Psych. 1. A study of basic human factors involved in the design and operation of machinery and equipment. Organized for students in engineering, industrial psychology, and the biological sciences. (Anderson.)

PSYCH. 145. EXPERIMENTAL PSYCHOLOGY: SENSORY PROCESSES. (4)

First and second semesters. Two lectures and two two-hour laboratory periods per week. Prerequisite, Psych. 90. Laboratory fee per semester, $4.00. Primarily for students who major or minor in psychology. A systematic survey of the laboratory methods and techniques applied to sensory and perceptual processes. (Fisher, Steinman.)

PSYCH. 146. EXPERIMENTAL PSYCHOLOGY: LEARNING, MOTIVATION, AND PROBLEM SOLVING. (4)

First and second semesters. Two lectures and two two-hour laboratory periods per week. Prerequisite, Psych. 90. Laboratory fee per semester, $4.00. Primarily for students who major or minor in psychology. The experimental analysis of learning and motivational processes. (Yarczower, Gollub, Turnage.)

PSYCH. 147. EXPERIMENTAL PSYCHOLOGY: SOCIAL BEHAVIOR. (4)

First and second semesters. Two lectures and one two-hour laboratory period per week. Laboratory fee, $4.00. Prerequisites, Psych. 21 and Psych. 90 or equivalent. A laboratory course dealing with methods of studying behavior in the social context. Topics will include social perception and motivation, small groups, communication and persuasion. Consideration will be given to the techniques involved in laboratory experimentation, field studies, attitude scale construction, and opinion surveys. (McGinnies, Higgs, Ward.)

Psych. 148. Psychology of Learning. (3)

First semester. Prerequisites, Psych. 146, or Psych. 145 and permission. Review and analysis of the major phenomena and theories of human and animal learning, including an introduction to the fields of problem solving, thinking and reasoning behavior. (Staff.)

Psych. 150. Tests and Measurements. (3)

First and second semesters. Prerequisite, Psych. 90. Laboratory fee, $4.00. Critical survey of measuring devices used in counseling, educational and industrial practice with an emphasis on the theory, development and standardization. Laboratory work will incorporate training in methodology of test development together with appropriate practice in the use of selected tests.
(Waldrop, Bartlett, Fretz.)

Psych. 151. Psychology of Individual Differences. (3)

First and second semesters. Prerequisites, Psych. 5 and 90. Problems, theories, and researches related to psychological differences among individuals and groups. (Heermann, Waldrop, Johnson.)

Psych. 161. Industrial Psychology. (3)

Second semester. Prerequisite, 6 hours in psychology. A course designed to aid in the understanding of the problems of people in a variety of work situations; serving as an introduction to such technical problems as personnel selection; interviewing, morale, supervision and management, and human relations in industry. Lecture, discussion and laboratory. (Heermann, Bartlett, O'Brien.)

Psych. 180. Physiological Psychology. (3)

Prerequisite, Psych. 145 or 146. An introduction to research on the physiological basis of human behavior, including considerations of sensory phenomena, motor coordination, emotion, drives, and the neurological basis of learning.
(Brady, McIntire, Hodos.)

Psych. 181. Animal Behavior. (3)

(Same as Zool. 181.) Second semester. Prerequisite, consent of instructor. A study of animal behavior, including considerations of social interactions, learning sensory processes, motivations, and experimental methods, with a major emphasis on mammals. (McIntire.)

Psych. 191. Senior Seminar. (3)

First semester. Prerequisites, senior standing and consent of the instructor. The historical and theoretical roots of the science of psychology. Analysis of current psychological theories and their related research. (Staff.)

Psych. 194. Independent Study in Psychology. (1-6)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. Integrated reading under direction, leading to the preparation of an adequately documented report on a special topic. (Staff.)

Psych. 195. Minor Problems in Psychology. (1-6)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. An individualized course designed to allow the student to pursue a specialized topic or research project under supervision. (Staff.)

For Graduates

(All the following courses require consent of the instructor. Not all of the graduate courses are offered every year. The times specified for each course are given as estimates.)

PSYCH. 200. PROSEMINAR: PROFESSIONAL ASPECTS OF PSYCHOLOGICAL SCIENCE. (1)

Prerequisite, consent of faculty advisor. Survey of professional problems in psychology, including considerations of contemporary developments, professional ethics, literature resources, formulation of critical research problems, and discussion of the major institutions requiring psychological services. (Staff.)

PSYCH. 201. SENSORY AND PERCEPTUAL PROCESSES. (3)

Alternate years. Prerequisites, Psych. 180 and 211. The contemporary experimental and theoretical literature on selected problems in sensation and perception. (Fisher, Steinman.)

PSYCH. 203, 204. GRADUATE SEMINAR. (3, 3)

Surveys of contemporary American and foreign research literature in specialized fields of psychology. (Staff.)

PSYCH. 205, 206. HISTORICAL VIEWPOINTS AND CURRENT THEORIES IN PSYCHOLOGY. (3, 3)

Alternate years. Prerequisite, Psych. 212. A study of the philosophical and scientific background of modern psychology, together with a review of its major systematic viewpoints and issues. (Battig.)

PSYCH. 207. CONDITIONING AND LEARNING. (3)

Alternate years. Prerequisite, Psych. 212. The literature on the experimental analysis of behavior, with examination of basic experiments and contemporary theories related to them. (Gollub, Yarczower, Turnage.)

PSYCH. 208. VERBAL BEHAVIOR. (3)

Alternate years. Prerequisite, Psych. 123 and 212. Analysis of such topics as verbal learning, psycholinguistics, concept formation, and thinking. (Turnage, Battig.)

PSYCH. 211, 212. ADVANCED GENERAL PSYCHOLOGY. (3, 3)

First and second semesters. Prerequisite, Psych. 145 or 146. A systematic review of the more fundamental investigations upon which modern psychology is based. (Staff.)

PSYCH. 213. ADVANCED LABORATORY TECHNIQUES. (1-3)

Methodology of the automatization of research techniques and apparatus: apparatus design and construction; telemetric and digital techniques; logical block circuitry. Laboratory fee, $5.00 per credit hour. (Staff.)

PSYCH. 214. COMPARATIVE PSYCHOLOGY. (3)

Prerequisite, Psych. 181 and 212. The experimental literature on the behavior of infra-human organisms. Special topics. (Yarczower, McIntire)

PSYCH. 215. ADVANCED PSYCHOPHYSIOLOGY. (3)

Alternate years. An advanced seminar dealing with special selected topics in the area of psychophysiology. (Brady, McIntire, Hodos.)

PSYCH. 216. SEMINAR IN PSYCHOPHARMACOLOGY. (3)

Prerequisite, one year of graduate study in psychology and consent of the instructor. A critical review and detailed analysis of the literature and problems related to the effects of drugs on animal and human behavior. Designed for advanced graduate students in experimental psychology and clinical psychology. (Brady, Gollub.)

PSYCH. 220. PSYCHOLOGICAL CONCEPTS IN MENTAL HEALTH. (3)

Each year. Prerequisite, advanced standing. Concepts in mental health, their theoretical status, experimental evidence, and current use. (Waldrop, Golann.)

PSYCH. 221. SEMINAR IN COUNSELING PSYCHOLOGY. (3)

Selected problems in counseling psychology. (Waldrop, Fretz.)

PSYCH. 222. SEMINAR IN CLINICAL PSYCHOLOGY. (3)

Selected problems in clinical psychology. (Pumroy, Daston, Walder.)

PSYCH. 223. SEMINAR IN COMMUNITY MENTAL HEALTH. (3)

Selected problems in mental health psychology. (Golann.)

PSYCH. 224. SEMINAR IN STUDENT PERSONNEL. (2)

Prerequisite, permission of instructor. The seminar is designed to acquaint the student with student personnel functions at the collegiate level. Attention is devoted to the historical antecedents of student personnel activities, the range of services, their functions, responsibilities, interrelationships and projected future status. Resource personnel presently engaged in student personnel services will participate as needed. (Staff.)

PSYCH. 225, 226. MEASUREMENT AND EVALUATION. (4, 4)

First and second semesters. Prerequisite, Psych. 150. Theory and logic of the methodology of evaluation. Laboratory practice in methods of appraisal. Survey of available testing instruments and techniques. Laboratory fee of $6 each semester. (Daston, Pumroy, Walder.)

PSYCH. 229. SEMINAR IN INDUSTRIAL PSYCHOLOGY. (3)

An advanced seminar covering specialized topics such as: morale and motivation, labor relations, consumer motivations, man-machine systems, quantitative and qualitative personnel requirements inventory, job evaluation, environmental conditions and safety, occupational choice and classification, and the interview. (Edgerton, Bartlett, O'Brien.)

PSYCH. 230. SEMINAR IN ENGINEERING PSYCHOLOGY. (3)

Alternate years. An advanced seminar covering the analysis of factors, variables, and characteristics of systems which affect human performance and efficiency. (Anderson.)

PSYCH. 231. TRAINING PROCEDURES IN INDUSTRY. (3)

Prerequisite, Psych. 148 or equivalent. A consideration of psychological principles and methods for improving job performance; skill development laboratory in application of methods and techniques is provided. (Edgerton, Bartlett)

PSYCH. 232. PERSONNEL SELECTION AND JOB ANALYSIS. (3)

Prerequisite, Psych. 161 or equivalent. Psychological measurement as applied to the analysis of job requirements and the development and use of performance criteria and predictors. (Edgerton, Bartlett, O'Brien.)

PSYCH. 233. SOCIAL ORGANIZATION IN INDUSTRY. (3)

Prerequisite, permission of instructor. Analysis of management organizations as social structures, and the application of concepts and methods of social psychology to problems of conflict, cooperation, and leader-group relations.
(O'Brien, Edgerton.)

PSYCH. 240. INTERVIEW AND QUESTIONNAIRE TECHNIQUES. (3)

Psychological concepts and methods in the use of interview, questionnaire, and inventory procedures for the measurement, prediction and alteration of behavior.
(Edgerton, O'Brien.)

PSYCH. 241. PERSUASION AND ATTITUDE CHANGE. (3)

Each year. Consideration of the communication process and the various media of mass communication. Factors related to the effectiveness of communication and persuasion are analyzed in the light of experimental evidence, and various strategies and techniques of persuasion are reviewed.
(McGinnies, Higgs, Ward.)

PSYCH. 242. SEMINAR IN SOCIAL PSYCHOLOGY. (3)

Each year. Analysis and discussion of contemporary systematic positions in social psychology. Review of research methods in the area as well as theories and problems of current importance. (McGillies, Higgs, Ward.)

PSYCH. 243. SEMINAR IN SMALL GROUP BEHAVIOR. (3)

Prerequisite, permission of instructor. Review of current approaches to small group behavior, including problem-solving, communication, leadership, and conformity. (Ward, Higgs.)

PSYCH. 252, 253. ADVANCED STATISTICS. (3, 3)

First and second semesters. Prerequisite, Psych. 90. Detailed study of the fundamentals of statistical inference, experimental design, and the analysis of regression and correlation concepts and techniques; a basic course for research students in the behavioral sciences. (Staff.)

PSYCH. 254. FACTOR ANALYSIS. (3)

Prerequisite, Psych. 253. Analysis of major developments in factor theory as applicable to the behavioral sciences, including computational methods and research implications. (Andrews.)

PSYCH. 255. SEMINAR IN PSYCHOMETRIC THEORY. (3)

Prerequisite, Psych. 253. Study of psychophysical methods, scaling technique, and the statistical methods of pattern analysis. (Staff.)

PSYCH. 256. MENTAL TEST THEORY. (3)

Prerequisite, Psych. 253. Development of test theory from psychophysics and measurement theory. Consideration of formal and applied problems involved in developing and utilizing phychological tests and measurements. Special attention is given to problems of reliability, validity, and prediction. (Bartlett.)

PSYCH. 257. SEMINAR IN QUANTITATIVE PSYCHOLOGY. (3)

Prerequisite, Psych. 253. An advanced seminar covering special topics in statistical and mathematical methods and models in psychology. (Staff.)

PSYCH. 258. DEVELOPMENT OF PREDICTORS. (3)

Prerequisite, Psych. 153. Review of statistical theory and practices in the design, development and analysis of techniques of prediction in the behavioral sciences, with special attention to the formal and practical problem of criteria for prediction. (Staff.)

PSYCH. 260. OCCUPATIONAL DEVELOPMENT AND CHOICE. (3)

Prerequisite, Psych. 220. Theoretical and research literature on occupational behavior. (Waldrop, Fretz.)

PSYCH. 261, 262. MODIFICATION OF HUMAN BEHAVIOR: RESEARCH METHODS AND PRACTICE. (3, 3)

First and second semesters. The experimental and applied methods available for the induction of behavior change, with emphasis on their relationship to community mental health (first semester); process, outcome, and theory in their application to counseling and psychotherapy (second semester). (Daston, Walder.)

PSYCH. 263, 264. MODIFICATION OF HUMAN BEHAVIOR: LABORATORY AND PRACTICUM. (3, 3)

First and second semesters. Application of methods relevant to behavior change in counseling and psychotherapy. Individual supervision and group consultation. Laboratory fee $6 per semester. (Staff.)

PSYCH. 265. ADVANCED DEVELOPMENTAL PSYCHOLOGY. (3)

Empirical, experimental and theoretical literature related to developmental processes. (Waldrop, Pumroy.)

PSYCH. 266. THEORIES OF MOTIVATION. (3)

Alternate years. Current treatments of motivational concepts, and analysis of the causal antecedents to behavior. (Staff.)

PSYCH. 267. THEORIES OF PERSONALITY. (3)

Scientific requirements for a personality theory. Postulates and relevant research literature for several current personality theories. (Daston, Walder.)

PSYCH. 269. PRACTICUM IN COMMUNITY MENTAL HEALTH CONSULTATION. (3)

Each year. Prerequisite, advanced standing. Directly supervised fieldwork in mental health consultation. (Staff.)

Psych. 270. Advanced Abnormal Psychology. (3)
Alternate years. Deviant behaviors and their etiology and taxonomy. (Daston, Walder.)

Psych. 271. Appraisal of Disabilities. (3)
Human disabilities and their psychological appraisal. (Daston, Waldrop.)

Psych. 272. Individual Clinical Diagnosis. (3)
Alternate years. Prerequisite, Psych. 226. Case study of emotionally disturbed individuals with a variety of psychological techniques. (Staff.)

Psych. 274. Evaluation and Change in Educational Skills. (3)
Methods for the enhancement of reading and other educational skills. (Maxwell.)

Psych. 285, 286. Research Methods in Psychology. (1-3, 1-3)
Each year. Research is conducted on several problems each semester, in a variety of fields of psychology, and under the supervision of various members of the faculty. (Staff.)

Psych. 288, 289. Special Research Problems. (1-4, 1-4)
First and second semesters. Supervised research on problems selected from the area of experimental, industrial, social, quantitative, or mental health psychology. (Staff.)

Psych. 399. Research. (credit arranged.)
First and second semesters. (Staff.)

SOCIOLOGY AND ANTHROPOLOGY

Professors: Hoffsommer, Janes, and Lejins.

Associate Professors: Anderson, Cussler, Hirzel, Shankweiler and Hoffman.

Assistant Professors: Coates, Franz, Motz, DiBella, Price, Pownall, Jones, Williams, and Avis.

The Department of Sociology grants the degrees of Master of Arts and Doctor of Philosophy. Fields of specialization include anthropology, criminology, rural and urban sociology, mental health, the family, industrial and occupational sociology, social theory, social psychology, intercultural sociology and research methods.

Prerequisites for graduate study leading to an advanced degree with a major in sociology consist of either (1) an undergraduate major (totalling at least 24 semester hours) in sociology or (2) 12 semester hours of sociology (including 6 semester hours of advanced courses) and 12 additional hours of comparable work in economics, political science, or

psychology. Reasonable substitutes for these prerequisites may be accepted in the case of students majoring in other departments who desire a graduate minor or several courses in sociology.

For Graduates and Advanced Undergraduates

Soc. 102. Intercultural Sociology. (3)

First semester. Prerequisite, Soc. 2. On the basis of a comparative study of customs, individual and group behavior patterns and institutions, this course studies the ideologies of America and other modern societies. (Staff.)

Soc. 111. Sociology of Occupations and Careers. (3)

First semester. The sociology of work and occupational life in modern society. Changing occupational ideologies, values and choices. Occupational status systems and occupational mobility. The social psychology of career success. (Coates, Jones.)

Soc. 112. Rural-Urban Relations. (3)

First semester. The ecology of population and the forces making for change in rural and urban life; migration, decentralization and regionalism as methods of studying individual and national issues. Applied field problems. (Cussler, Jones.)

Soc. 113. The Rural Community. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. A detailed study of rural life with emphasis on levels of living, the family, school, and church and organizational activities in the fields of health, recreation, welfare, and planning. (Hoffsommer, Hirzel.)

Soc. 114. The City. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The rise of urban civilization and metropolitan regions; ecological process and structure; the city as a center of dominance; social problems, control and planning. (Hirzel.)

Soc. 115. Industrial Sociology. (3)

First and second semesters. The sociology of human relations in American industry and business. Complex industrial and business organizations as social systems. Social relationship within and between industry, business, community and society. (Coates, Jones.)

Soc. 116. Military Sociology. (3)

First and second semesters. The sociology of military life. Social change and the growth of military institutions. Complex formal military organizations. Military organizations as social systems. Military service as an occupation or profession. Career patterns, problems and satisfactions. Relations between military institutions, civilian communities and society. (Coates.)

Soc. 118. Community Organization. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Community organization and its relation to social welfare; analysis of community needs and resources; health, housing, recreation; community centers; neighborhood projects. (DiBella.)

Soc. 121. Population. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Population distribution and growth in the United States and the world; population characteristics of the U. S.; resulting population problems and policies. (Hirzel.)

Soc. 122. Population. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Trends in fertility and mortality, migrations, population estimates and the resulting problems and policies. (Hirzel.)

Soc. 123. Ethnic Minorities. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Basic social processes in the relations of ethnic groups within the State; immigration groups and the Negro in the United States; ethnic minorities in Europe. (Lejins.)

Soc. 131. Introduction to Social Service. (3)

First and second semesters. General survey of the field of social-welfare activities; historical development; growth, functions, and specialization of agencies and services, private and public. (DiBella.)

Soc. 136. Sociology of Religion. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Varieties and sources of religious experience. Religious institutions and the role of religion in social life. (Anderson.)

Soc. 141. Sociology of Personality. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Development of human nature and personality in contemporary social life; processes of socialization; attitudes, individual differences, and social behavior. (Motz, Cussler.)

Soc. 144. Collective Behavior. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Social interaction in mass behavior; communication processes; structure and functioning of crowds, strikes, audiences, mass movements, and the public. (Cussler.)

Soc. 145. Social Control. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Forms, mechanisms, and techniques of group influence on human behavior; problems of social control in contemporary society. (Motz.)

Soc. 147. Sociology of Law. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Law as a form of social control; interrelation between legal and other conduct norms as to their content, sanctions, and methods of securing conformity; law as an integral part of the culture of the group; factors and processes operative in the formation of legal norms as determinants of human behavior. (Lejins.)

Soc. 153. Juvenile Delinquency. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Juvenile delinquency in relation to the general problem of crime; analysis of factors underlying juvenile delinquency; treatment and prevention. (Lejins.)

Soc. 154. Crime and Delinquency Prevention. (3)

Second semester. Prerequisites, Soc. 1 or its equivalent; Soc. 52, Soc. 153, or consent of instructor. Methods and programs in prevention of crime and delinquency. (Lejins.)

Soc. 155. Treatment of Criminals and Delinquents in the Community. (3)

Prerequisites, Soc. 52, 152, or consent of instructor. Analysis of the processes and methods in the modification of criminal patterns of behavior in a community setting. (Lejins, Pownall.)

Soc. 156. Institutional Treatment of Criminals and Delinquents. (3)

First semester. Prerequisites, Soc. 1, or its equivalent; Soc. 52, Soc. 153, or consent of instructor. History, organization and functions of penal and correctional institutions for adults and juveniles. (Lejins, Pownall.)

Soc. 161. The Sociology of War. (3)

Second semester. The origin and development of armed forces as institutions; the social causes, operations and results of war as social conflict; the relations of peace and war and revolution in contemporary civilization. (Coates.)

Soc. 162. Basic Principles and Current Practice in Public Welfare. (3)

Summer session only. (DiBella.)

Soc. 164. The Family and Society. (3)

Second semester. Prerequisites, Soc. 1 and Soc. 64 or its equivalent. Study of the family as a social institution; its biological and cultural foundations, historic development, changing structure and function; the interaction of marriage and parenthood, disorganizing and reorganizing factors in present day trends. (Shankweiler, Motz, Harper.)

Soc. 166. Interviewing and Problem Solving in Social Work. (3)

Prerequisite, Soc. 131, or concurrent registration. The principles of interviewing and other diagnostic techniques as applied to social problems with particular reference to family and child behavior. (DiBella.)

Soc. 171. Family and Child Welfare. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Programs of family and child welfare agencies; social services to families and children; child placement; foster families. (DiBella.)

Soc. 173. Social Security. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The social security program in the United States; public assistance; social insurance. (DiBella.)

Soc. 174. Public Welfare. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Development and organization of the public welfare movement in the United States, social legislation interrelations of federal, state, and local agencies and institutions. (DiBella.)

Soc. 180. Small Group Analysis. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Analysis of small group structure and dynamics. Review of research on small groups in factories, military service, schools and communities. Presentation of techniques used in the study of small groups. (Franz.)

Soc. 186. Sociological Theory. (3)

First and second semesters. Prerequisites, Soc. 1, or its equivalent. Development of the science of sociology; historical backgrounds; recent theories of society. (Janes, Motz, Hirzel, Price.)

Soc. 191. Social Field Training. (1-3)

First and second semesters. Prerequisites: For social work field training, Soc. 131; for crime control field training, Soc. 52 and 153. Enrollment restricted to available placements. Supervised field training in public and private social agencies. The student will select his particular area of interest and be responsible to an agency for a definite program of in-service training. Group meetings, individual conferences and written program reports will be a required part of the course. (Staff.)

Soc. 193. Independent Reading Course in Sociology. (3)

This course is designed for the needs of the honors students in Sociology.

Soc. 194. Independent Research in Sociology. (3)

This course is designed for the needs of the honors students in Sociology.

Soc. 195. Intermediate Statistics for Sociologists. (3)

Prerequisites, Sociology 95 or equivalent and a course in Sociology (other than Sociology 1). Intermediate correlation techniques; analysis of variance; sampling; additional non-parametric techniques; additional topics in inferential statistics. Required for all candidates for the master's degree. (Henkel.)

Soc. 196. Senior Seminar. (3)

Second semester. Required of and open only to senior majors in sociology. Scope, fields, and research methods of sociology; practical applications of sociological knowledge. Individual study and reports. (Cussler, Hoffsommer.)

For Graduates

Soc. 201. Methods of Social Research. (3)

First semester. Selection and formulation of research projects; methods and techniques of sociological investigation and analysis. Required of graduate majors in sociology. (Hoffsommer.)

Soc. 214. Survey of Urban Theory. (3)

Prerequisite, Sociology 14 or 114 or equivalent. Theoretical approaches of Sociology and other Social Sciences to urbanism, urbanization, and urban phenomena. Selected approaches: Chicago School; metropolitan region; demography; institutions. (Janes, Hirzel, Staff.)

Soc. 215. Community Studies. (3)

First semester. Intensive study of the factors affecting community development and growth, social structure, social stratification, social mobility and social institutions; analysis of particular communities. (Staff.)

SOC. 216. SOCIOLOGY OF OCCUPATIONS AND PROFESSIONS. (3)
Second semester. An analysis of the occupational and professional structure of American society, with special emphasis on changing roles, functions, ideologies, and community relationships. (Coates.)

SOC. 217. SEMINAR IN FIELD WORK IN URBAN RESEARCH. (3)
Prerequisite, Sociology 214. Methods of Research in Sociology applied to the urban and metropolitan community; reviews of needed research; reviews of contemporary research; the design and execution of fiield studies. (Hirzel.)

SOC. 221. POPULATION AND SOCIETY. (3)
Second semester. Selected problems in the field of population; quantitative and qualitative aspects; American and world problems. (Hirzel.)

SOC. 230. COMPARATIVE SOCIOLOGY. (3)
Second semester. Comparison of the social institutions, organizations, patterns of college behavior, and art manifestations of societal values of various countries. (Staff.)

SOC. 241. PERSONALITY AND SOCIAL STRUCTURE. (3)
First semester. Comparative analysis of the development of human nature, personality, and social traits in select social structures. (Cussler.)

SOC. 246. PUBLIC OPINION AND PROPAGANDA. (3)
Second semester. Process involved in the formation of mass attitudes; agencies and techniques of communication; quantitative measurement of public opinion. (Motz.)

SOC. 250. FORMAL ORGANIZATION. (3)
The study of organizations; the nature of organizations; types of organizations; determinants and consequences of organizational growth; determinants and consequences of growth for administrative staff; determinants of effectiveness; and research in organizations. (Price.)

SOC. 253. ADVANCED CRIMINOLOGY. (3)
First semester. Survey of the principal issues in contemporary criminological theory and research. (Lejins.)

SOC. 254. SEMINAR: CRIMINOLOGY. (3)
Second semester. Selected problems in criminology. (Lejins.)

SOC. 255. SEMINAR: JUVENILE DELINQUENCY. (3)
First semester. Selected problems in the field of juvenile delinquency. (Lejins.)

SOC. 256. CRIME AND DELINQUENCY AS A COMMUNITY PROBLEM. (3)
Second semester. An intensive study of selected problems in adult crime and juvenile delinquency in Maryland. (Lejins.)

SOC. 257. SOCIAL CHANGE AND SOCIAL POLICY. (3)
First semester. Emergence and development of social policy as related to social change, policy-making factors in social welfare and social legislation. (Price.)

SOC. 262. FAMILY STUDIES. (3)

Second semester. Case studies of family situations; statistical studies of family trends, methods of investigation and analysis. (Shankweiler.)

SOC. 263. MARRIAGE AND FAMILY COUNSELING. (3)

Second semester. Prerequisites, Soc. 64 or Soc. 164 or consent of instructor. A sociological analysis of an emerging, family-centered profession. (Shankweiler.)

SOC. 264. THE SOCIOLOGY OF MENTAL HEALTH. (3)

First semester. A study of the sociological factors that condition mental health together with an appraisal of the group dynamics of its preservation. (Staff.)

SOC. 271. THEORY OF SOCIAL INTERACTION. (3)

Positions of major sociologists and social psychologists as to how the individual interacts with various groups and the issues involved. Trends in recent interaction theory. (Cussler.)

SOC. 282. SOCIOLOGICAL METHODOLOGY. (3)

Second semester. Logic and method of sociology in relation to the general theory of scientific method; principal issues and points of view. (Henkel.)

SOC. 286. DEVELOPMENT OF EUROPEAN AND AMERICAN SOCIOLOGICAL THEORY. (3)

Prerequisite, Sociology 186 or equivalent. Review of systematic sociological theories (such as Positivism, Organicism, Conflict, etc.) from the early 19th Century to the present. A review of the emerging self-evaluation of Sociology. (Janes.)

SOC. 287. SOCIOLOGICAL THEORY. (3)

Prerequisite, Sociology 186 or equivalent Systematic examination of contemporary sociological theories such as structural functionalism and social action. Special reference is given to the relevance of each theory to the conduct of sociological investigation. (Janes.)

SOC. 291. SPECIAL SOCIAL PROBLEMS. (Credit to be determined)

First and second semesters. Individual research on selected problems. (Staff.)

SOC. 295. ADVANCED STATISTICS FOR SOCIOLOGISTS. (3)

Prerequisite, Sociology 195 or equivalent. Advanced treatment of inferential statistics; sampling; research design; non-parametric techniques; scaling. Required of all candidates for the Ph.D. degree. (Henkel.)

SOC. 399. THESIS RESEARCH. (Credit to be determined)

First and second semesters. (Staff.)

ANTHOPOLOGY

Anthropology 1 or its Anthropology equivalent is prerequisite to all other courses in Anthropology.

For Advanced Undergraduates and Graduates

Anth. 105. Cultural Anthropology. (3)
A survey of the simpler cultures of the world, with attention to historical processes and the application of anthropological theory to the modern situation. (Staff.)

Anth. 106. Archeology. (3)
A survey of human cultural developments as revealed by archeological methods, with materials to be drawn from selected areas of both Old and New Worlds. (Staff.)

Anth. 124. The Culture of The American Indian. (3)
A study of type cultures; cultural processes; and the effects of acculturation on selected tribes of Indians in the Americas. (Anderson, Williams.)

Anth. 125. Cultural History of The Negro. (3)
The cultures of Africa south of the Sahara and the cultural adjustments of the Negro in North and South America. (Anderson.)

For Graduates

Anth. 224. Race and Culture. (3)
Prerequisite, permission of the instructor. Race and culture in contemporary society; mobility and the social effects of race and culture contacts and intermixture. (Anderson.)

SPEECH AND DRAMATIC ART

Professors: Strausbaugh, and Hendricks.

Associate Professors: Aylward, Linkow, Niemeyer, Pugliese, and Weaver.

Assistant Professors: Baker, Baratz, Craven, Doudna, Frank, Meersman, Provensen, Schmitt, and Schwartz.

Associate Research Professor: Causey.

Lecturers: Spuehler, Goldiamond, and Hedlund.

Instructors: Carter, Kanstoroom, Kirkley, McCain, and Schlesinger.

The Department offers a graduate course of study in the fields of dramatics, general speech, radio-television, or in speech and hearing science leading to the Master of Arts degree. The Department also offers work leading to the degree of Doctor of Philosophy in Speech and Hearing Science.

Department requirements, supplementary to the Graduate School requirements, have been formulated in each of the fields for the guidance of students. Copies may be obtained from the Department.

For Graduates and Advanced Undergraduates

Speech 102. Radio Production. (3)

Second semester. Prerequisite, Speech 22. Laboratory fee, $2.00. A study of the multiple problems facing the producer. Special emphasis is given to acoustic setup, casting, "miking," timing, cutting, and the coordination of personnel factors involved in the production of radio programs. (Kirkley.)

Speech 105. Speech—Handicapped School Children. (3)

Second semester. Prerequisite, Speech 3 for undergraduates. The occurrence, identification and treatment of speech handicaps in the classroom. An introduction to speech pathology. (Craven, Staff.)

Speech 106. Clinical Practice. (1 to 5 credits, up to 9)

Each semester; summer session. Prerequisite, Speech 105. Laboratory fee, $1.00 per hour. Clinical practice in various methods of corrective procedures with various types of speech cases in the University Clinic, veterans hospitals, and the public schools. May be taken for 1-5 credit hours per semester. May be repeated for a total of 9 semester hours credit. (Craven, Staff.)

Speech 107. Advanced Oral Interpretation. (3)

Second semester. Prerequisite, Speech 13. Emphasis upon the longer reading. Program planning. (Provensen.)

Speech 108. Educational Phonetics. (3)

This course is designed to relate phonetic science to the classroom. An extensive coverage of broad transcription of General American speech. Students having credit for Speech 3 or any previous phonetics course are not eligible for this course. (Hendricks.)

Speech 109. Speech and Language Development of Children. (3)

Second semester. Admission by consent of instructor. An analysis of normal and abnormal processes of speech and language development in children. (Hendricks.)

Speech 110. Advanced Group Discussion. (3)

First and second semesters. Prerequisite, Speech 10. Required in speech curriculum and elective in other curricula. An examination of current research and techniques in the discussion and conference including extensive practice in this area. (Linkow.)

Speech 111. Seminar. (3)

First and second semesters. Prerequisites, senior standing and consent of instructor. Present-day speech research. (Strausbaugh.)

Speech 112. Phonetics. (3)

First semester. Prerequisite, Speech 3 or consent of instructor. Laboratory fee, $3.00. Training in the recognition and production of the sounds of spoken English, with an analysis of their formation. Practice in transcription. Mastery of the international Phonetic Alphabet. (Baker.)

Speech 113. Play Production. (3)

Second semester. Prerequisite, Speech 16 or consent of instructor. Development of procedure followed by the director in preparing plays for public performance. (Meersman.)

Speech 114. The Film as an Art Form. (3)

First and second semester. Laboratory fee, $10.00 (effective September, 1964). A study of the motion picture as a developing form of entertainment, communication, and artistic expression. A series of significant American and foreign films are viewed to illustrate the artistic, historical and sociological trends of the twentieth century. (Niemeyer.)

Speech 115. Radio and Television in Retailing. (3)

First semester. Limited to students in the College of Home Economics. Prerequisite, Speech 1 or 7. Laboratory fee, $2.00. Writing and production of promotional programs for the merchandising of wearing apparel and house furnishings. Collaboration with Washington and Baltimore radio stations and retail stores. (Kirkley.)

Speech 116. Radio and Television Announcing. (3)

Second semester. Prerequisites, Speech 4 and 22 or consent of instructor. Laboratory fee, $2.00. The theory and application of all types of announcing. (Staff.)

Speech 117. Radio and Television Continuity Writing. (3)

First semester. Prerequisite, Speech 22 or consent of instructor. A study of the principles, methods and limitations of writing for radio and television. Application will be made in the writing of general types of continuities and commercials. (Kirkley.)

Speech 120. Speech Pathology. (3)

First semester. Prerequisite, Speech 105. Laboratory fee, $3.00. A continuation of Speech 105, with emphasis on the causes and treatment of organic speech disorders. (Carter.)

Speech 124, 125. American Public Address. (3, 3)

First and second semesters. Prerequisite, Speech 1 or 7. The first semester covers the period from colonial times to the Civil War period. The second semester covers from the Civil War period through the contemporary period. (Schwartz.)

Speech 126. Semantic Aspects of Speech in Human Relations. (3)

Second semester. Prerequisite, one course in public speaking. An analysis of speech and language habits from the standpoint of general semantics. (Hendricks.)

Speech 127. Children's Dramatics. (3)

Principles and methods necessary for staging children's productions on the elementary school level. Major emphasis on creative dramatics; the application of creative dramatics in the school room, and the values gained by the child in this activity. Students will conduct classes in formal and creative dramatics which will culminate in children's programs. (Schlesinger.)

Speech 129, 130. Play Directing. (3, 3)

Admission by consent of instructor. A lecture-laboratory course dealing with the fundamentals of script cutting, pacing, movement, blocking, and rehearsal routine as applied to the directing of plays. (Pugliese, Meersman.)

Speech 131. History of the Theatre. (3)

First semester. A survey of dramatic production from early origins to 1800. (Niemeyer.)

Speech 132. History of the Theatre. (3)

Second semester. A survey of dramatic production from 1800 to present. (Niemeyer.)

Speech 133. Communication Processes in Conferences. (3)

Second semester. Prerequisite, Speech 103 and 104 or the equivalent. Limited to students in the military studies curriculum. Group participation in conferences, methods of problem solving, semantic aspects of language and the function of conferences in industry and government. (Linkow.)

Speech 135. Instrumentation in Speech and Hearing Science. (2)

First semester. Prerequisite, Speech 3. Laboratory fee, $2.00. The use of electronic equipment in the measurement of speech and hearing. (Linkow.)

Speech 136. Principles of Speech Therapy. (3)

Prerequisite, Speech 120. Laboratory fee, $3.00. Differential diagnosis of speech and language handicaps and the application of psychological principles of learning, motivation and adjustment in the treatment of speech disorders. Craven.)

Speech 138. Methods and Materials in Speech Correction. (3)

Prerequisite, Speech 120 or the equivalent. Laboratory fee, $3.00. The design and use of methods and materials for diagnosis, measurement, and retaining of the speech-handicapped. (Craven.)

Speech 139. Theatre Workshop. (3)

First and second semesters. Prerequisite, Speech 8 or Speech 14. A laboratory course designed to provide the student with practical experience in all phases of theatre production. Consent of instructor. (Strausbaugh.)

Speech 140. Principles of Television Production. (3)

First semester. Laboratory fee, $5.00 (effective September, 1964). Three hour lecture, two hour laboratory. Prerequisite, Speech 22. A study of the theory, methods, techniques and problems of television production and direction. Units of study covering television cameras and lenses, lighting theory and practices, scenery and properties, costumes and makeup, graphic arts and special effects, are included. Observation of production procedures at nearby television stations. Application will be made through crew assignments for University-produced television programs. (Wolfe.)

Speech 141. Introduction to Audiometry. (2)

First semester. Prerequisite, Speech 3. Required for students whose concentration is in speech and hearing therapy. Laboratory fee, $2.00. Analysis of various methods and procedures in evaluating hearing losses. (Doudna.)

Speech 142. Speech Reading and Auditory Training. (2)

Second semester. Prerequisite, Speech 3. Required for students whose concentration is in speech and hearing therapy. Laboratory fee, $2.00. Methods of training individuals with hearing loss to recognize, interpret, and understand spoken language. (Doudna.)

Speech 146. Television News and Public Affairs. (3)

Second semester. Prerequisite, Speech 117 or Journ. 101. Training in presentation of television news, interviews, discussions and forums. (Schlesinger.)

Speech 147. Analysis of Broadcasting Processes and Effects. (2)

First semester. Prerequisite, Speech 22 or consent of instructor. Survey of the more common analytic approaches, methods, and results in the field of radio and television. (Wolfe.)

Speech 148. Television Direction. (3)

First semester. Two hour lecture, three hour laboratory. Prerequisite, Speech 22 or Speech 140. Laboratory fee, $10.00. Principles of television direction including analysis of script, casting, rehearsing, production, and video control. (Aylward.)

Speech 149. Television Workshop. (3)

Second semester. Two hour lecture, four hour laboratory. Prerequisites, Speech 22, 140 or 148, or consent of instructor. Laboratory fee, $10.00. Advanced laboratory course dealing with all phases of producing a complete television program. (Wolfe.)

Speech 150. Radio and Television Station Management. (2)

Second semester. Prerequisite, Speech 22 or consent of instructor. Broadcasting regulations, licenses, personnel functions, sales, advertising, and program and station promotion. (Batka.)

Speech 161. Ancient Rhetoric. (3)

Second semester. Prerequisite, Speech 2 or 11. The theories of speechmaking and speech composition as propounded by the classical rhetoricians. Special attention is given to Plato, Aristotle, Socrates, Cicero, Quintillian and St. Augustine. (McCain.)

Speech 163. Materials and Programs for the Development of Listening. (3)

Second semester. The study of research findings, listening tests, materials, equipment, and programs which can be used to develop listening skills. (Frank.)

Speech 164. Persuasion in Speech. (3)

Second semester. Prerequisite, Speech 2 or 11. A study of the bases of persuasion with emphasis on recent experimental developments in persuasion. (Weaver.)

Speech 171. Styles and Theories of Acting. (3)

Second semester. Prerequisite, Speech 8 or consent of instructor. The study and application of historical styles and theories of acting. (Pugliese.)

Speech 175. Stage Design and Lighting. (3)

Second semester. Prerequisite, Speech 14 or consent of instructor. The theory of stage design and lighting. Making of plans and lighting plots as coordinate elements of scenic art. (Schmitt.)

Speech 180. Honors Seminar. (3 Hrs.)

For honors students only. Readings, symposiums, visiting lecturers, discussions. (Staff.)

For Graduates

(All the following courses require consent of instructor.)

The Department maintains a reciprocal agreement with the Veterans Administration Hospital Washington, D.C., whereby clinical practice in speech and hearing rehabilitation may be obtained. These are in addition to university facilities where such clinical practice may also be obtained.

Speech 201. Special Problems Seminar. (A through K) (1-3)

(6 hours applicable toward M.A. degree.) Prerequisites, 6 hours of speech pathology and consent of instructor. A. stuttering; B. cleft palate; C. delayed speech; D. articulation; E. cerebral palsy; F. voice; G. special problems of the deaf; H. foreign dialect; I. speech intelligibility; J. neurophysiology of hearing; K. minor research problems. (Hendricks, Staff.)

Speech 202. Techniques of Research in Speech and Hearing. (3)

First semester. Prerequisite, 12 hours of speech pathology and audiology. Required of candidates for master's degree in speech and hearing therapy. Analysis of research methodology including experimental techniques, statistical analysis and preparation of reports for scientific investigations in speech and hearing science. (Williams.)

Speech 203. Experimental Phonetics I. (3)

Prerequisite, Speech 112. Laboratory fee, $3.00. The application of experimental methods in the quantitative analysis of the phonetic elements of speech. (Baker.)

Speech 204. Applied Phonetics. (3)

Prerequisite, Speech 112 or equivalent. Laboratory fee, $3.00. Application of phonetic analysis to communication systems and clinical analysis in speech and hearing. (Baker.)

Speech 205. Descriptive Phonetics. (3)

Prerequisite, Speech 112 or equivalent. Laboratory fee, $3.00. Application of phonetic analysis in the transcription of dialects. (Baker.)

Speech 206. Diagnostic Procedures in Speech Pathology. (3)

Prerequisite, 6 hours of speech pathology. A study of diagnostic tools and methods in the analysis of various types of speech disorders. (Hendricks, Staff.)

Speech 207. Advanced Principles of Speech and Hearing Therapy. (3)

Prerequisite, Speech 136 or equivalent, and 6 hours of speech and hearing pathology. A review of learning principles as applied to the training of the speech and hearing handicapped. (Hendricks.)

Speech 208. Quantitative Methods in Speech and Hearing Science. (3)

An analysis of current procedures used in quantifying phenomena observed in Speech and Hearing Science. A minimum of 12 hours credit in Speech and Hearing is a prerequisite for this course. (Staff.)

Speech 210. Anatomy and Physiology of Speech and Hearing. (3)

Prerequisites, 6 hours of speech pathology and audiology and consent of instructor. Laboratory fee, $3.00. A study of the anatomy and physiology of the auditory and speech mechanisms. (Carter.)

Speech 211. A, B, C, D. Advanced Clinical Practice. (1-3 up to 12)

(6 hours applicable toward M.A. degree.) Prerequisite, 12 hours of speech pathology and audiology. Laboratory fee, $1.00 per hour. Supervised training in the application of clinical methods in the diagnosis and treatment of speech and hearing disorders. (Craven.)

Speech 212. Advanced Speech Pathology. (3)

Second semester. Prerequisites, 6 hours in speech pathology and consent of instructor. Laboratory fee, $3.00. Etiology and therapy for organic and functional speech disorders. (Carter.)

Speech 214. Clinical Audiometry. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Laboratory fee, $3.00. Testing of auditory acuity with pure tones and speech. (Doudna.)

Speech 216. Communications Skills for the Hard-of-Hearing. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Speech reading, auditory training, and speech conservation problems in the rehabilitation of the hard-of-hearing. (Doudna.)

Speech 217. Selection of Prosthetic Appliances for the Acoustically Handicapped. (3)

Second semester. Prerequisite, Speech 214. Laboratory fee, $3.00. A laboratory course in modern methods of utilizing electronic hearing aids. (Staff.)

Speech 218. Speech and Hearing in Medical Rehabilitation and Special Education Programs. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Administrative problems involved in the organization and operation of speech and hearing therapy under different types of programs. (Hendricks.)

Sfeech 219. Speech Disorders of the Brain-Injured. (3)

Prerequisites, 6 hours in pathology and audiology and consent of instructor. Laboratory fee, $3.00. Methods of evaluation and treatment of children and adults who have suffered injury to brain tissue, with subsequent damage to speech and language processes. (Hendricks.)

Speech 220. Experimental Audiology. (3)

Second semester. Prerequisite, 6 hours in audiology. Laboratory fee, $3.00. A study of experimental techniques in the investigation of problems in audiology and psycho-acoustics. (Causey, Staff.)

Speech 221. Communication Theory and Speech and Hearing Problems. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Analysis of current theories of communication as they apply to research and therapy in speech and hearing. (Hendricks.)

Speech 222. Advanced Bio-Acoustics. (3)

Prerequisite, 6 hours of audiology. Laboratory fee, $3.00. Laboratory research methods in the study of hearing mechanisms in animals. (Staff.)

Speech 223. Advanced Psycho-Acoustics. (3)

Prerequisite, 6 hours of audiology. Laboratory fee, $3.00. Research methodology in the study of human hearing. (Staff.)

Speech 224. The Preparation of Speech and Hearing Scientists in Institutions of Higher Learning. (3)

Prerequisite, 6 hours of audiology and 6 hours of speech pathology. A review of problems involved in the training of personnel who expect to take teaching and research positions at university and college level. (Hendricks.)

Speech 225. Advanced Semantics. (3)

Prerequisite, 3 hours of semantics. Laoratory fee, $3.00. Advanced study of the effects of language in human perception. (Hendricks.)

Speech 226. Language Problems of the Exceptional Child. (3)

Prerequisite, 6 hours of speech pathology. A survey of special language problems of the mentally retarded, brain-injured, hard-of-hearing and deaf children. (Carter.)

Speech 227. Experimental Design in Speech and Hearing Science. (3)

A seminar devoted to planning and conducting experiments in speech and hearing science. Laboratory fee, $10.00. Each student is required to present three pilot studies for discussion. Two hours classwork, two hours laboratory. Permission of instructor required. (Staff.)

Speech 240. Seminar in Broadcasting. (3)

First semester. Studies of various aspects of broadcasting. (Aylward.)

Speech 241. Special Problems in Broadcasting. (3)

Second semester. An experimental laboratory course for the development of new ideas in broadcasting. (Staff.)

Speech 248. Advanced Television Direction. (3)

Prerequisite, Speech 148 or consent of instructor. Principles of television direction as applied to dramatic programs, together with a consideration of the specific aesthetic values of the television medium. (Aylward.)

Speech 260. Speech and Drama Programs in Higher Education. (3)

First semester. A study of current theories and practices in speech and drama. (Frank, Staff.)

Speech 261. Introduction to Graduate Study in Speech. (3)

First semester. (Weaver.)

Speech 262. Special Problems in General Speech. (3)
First semester. (Weaver.)

Speech 263. Rhetorical Theories of Style. (3)
Prerequisite, consent of instructor. Examination of selected theories of style drawn from the fields of rhetoric and literature, and analysis of model speeches. (Schwartz.)

Speech 264. Interpersonal Communication. (3)
Problems and processes involved in the use of language in interpersonal communication. (Weaver.)

Speech 270. Seminar: Studies in Theatre. (3)
First semester. Research projects adapted to individual backgrounds and special work. (Meersman.)

Speech 271. The Theory of Pre-Modern Dramatic Production. (3)
Second semester. Examination and execution of production styles. (Pugliese.)

Speech 272. Special Problems in Drama. (3)
Second semester. The preparation of adaptations and other projects in dramaturgy. (Pugliese.)

Speech 273. Theories of the Drama. (3)
Advanced study of the identification and development of dramatic form from the early Greek drama to contemporary forms; the esthetics of theatre arts; and dramatic criticism. (Meersman.)

Speech 290. Independent Study. (1-3)
Prerequisite, consent of instructor. An individual course designed for intensive study or research of problems in any one of the three areas of: drama, general speech, or radio/TV. (Staff.)

Speech 301. Independent Study in Speech and Hearing Science. (1-6)
Student-selected topic of investigation. A proposed topic must be approved prior to registration. In addition to a formal report an oral presentation of the results will be required. May be repeated. Prerequisite, 30 hours of graduate study in speech and hearing science. (Staff.)

Speech 399. Research. (1-6)
Credit in proportion to work done and results accomplished. (Staff.)

VETERINARY SCIENCE

Professors: DeVolt and Ladson.

Assistant Professors: Brown and Mohanty.

No advanced degrees are given in the Department of Veterinary Science. Graduate students in other departments are accepted for problems in the Department of Veterinary Science upon approval of the Department in which the graduate degree may be given.

For Graduates and Advanced Undergraduates

An. Sc. 116. Anatomy of Domestic Animals. (3)

First semester. One lecture and two laboratory periods per week. A systematic, comparative study of the pig, ruminants and fowl, with special emphasis of those systems important in animal production. Prerequisite, Zool. 1. (Brown.)

An. Sc. 117. Introduction to Diseases of Animals. (3)

Second semester. Two lectures and one laboratory period per week. This course gives basic instruction in the nature of disease: including causation. immunity, methods of diagnosis, economic importance, public health aspects and prevention and control of the common diseases of sheep, cattle, swine, horses, and poultry. Prerequisites, Micro. 1, and Zool. 1. (Brown.)

An. Sc. 170. Poultry Hygiene. (3)

Second semester. Two lectures and one laboratory period per week. Virus, bacterial, and protozoan diseases; parasitic diseases, prevention, control and eradication. Prerequisites, Micro. 1, and An. Sc. 1. (DeVolt.)

An. Sc. 171. Avian Anatomy. (3)

First semester. Two lectures and one laboratory per week. Gross and microscopic structure, dissection and demonstration. Prerequisite, Zool. 1. (DeVolt.)

For Graduates

An. Sc. 200. Electron Microscopy. (3)

First and second semesters. One lecture and two laboratory periods per week. Theory of the electron microscope, preparation of specimens, manipulations and photography. (Mohanty.)

An. Sc. 399. Research. (1-12)

First and second semesters. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of animal science, carrying the same to completion, and reporting the results in the form of a thesis. (Staff.)

ZOOLOGY

Professors: Anastos, Crenshaw, and Schoenborn.

Research Professor: Schleidt.

Research Professors (part-time): Glinos, Humphrey, Kuntz, and Sadun.

Associate Professors: Bernstein, Brown, Grollman, Highton, Jachowski, Linder, Ramm, and Stross.

Research Associate Professor: Eisenberg.

Assistant Professors: Brinkley, Ficken, Gainer, Goldman, Keller, Nelson, Potter, and Schmittner.

Research Assistant Professor: Elbl.

The Department of Zoology offers programs of study leading to the degrees of Master of Science and Doctor of Philosophy with specialization in the following fields: cellular, organ, comparative and nerve physiology; invertebrate and vertebrate endocrinology; biophysics; cytology; developmental zoology; population, biochemical, radiation and general genetics; animal behavior; ecology, hydrobiology; parasitology, protozoology, helminthology, acarology; invertebrate zoology; systematics; ichthyology, herpetology ornithology and mammalogy. The general academic requirements which must be fulfilled for the M.S. and Ph.D. degrees are described earlier in the catalog.

Admission to graduate study in the Department is restricted to students with an adequate undergraduate preparation in physical as well as biological sciences. This would include upper division courses in zoology, and courses in mathematics, physics and chemistry through organic. Able students who lack preparation in a particular area may be admitted provided that the deficiency is corrected early in the graduate work. Applicants should submit the results of the Graduate Record Examination.

For further information and application forms, write to the Director of Graduate Studies, Department of Zoology, University of Maryland, College Park, Maryland, 20740.

All Zoology courses with laboratory have a laboratory fee of $12.00 per course per semester.

For Graduates and Advanced Undergraduates

Zool. 102. Vertebrate Physiology. (4)

First semester. Three lectures and one three-hour laboratory period a week. Prerequisites, one year of zoology and one semester of organic chemistry. An intensive study of nerve, muscle, sensory receptors and the central nervous system. (Gainer.)

ZOOL. 103. BIOPHYSICS. (3)

Second semester. Three lectures a week. Prerequisites, one year of biology and one year of either physics or physical chemistry, or permission of the instructor. A course designed to acquaint the student with the scope of biophysics and to provide an introduction to the analysis of cells and tissues as physical-chemical systems. (Goldman.)

ZOOL. 104. VERTEBRATE PHYSIOLOGY. (4)

Second semester. Three lectures and one three-hour laboratory period a week. Prerequisites, one year of zoology and one semester of organic chmistry. An intensive study of the cardiovascular, gastrointestinal, renal and respiratory systems, and an introduction to endocrinology, basal metabolism and reproductive physiology. (Grollman.)

ZOOL. 105. GENERAL ENDOCRINOLOGY. (3)

First semester. Three lectures each week. Prerequisites, one year of zoology and one semester of organic chemistry. The study of the functions and the functioning of the endocrine organs of animals, with special reference to the vertebrates. (Brinkley.)

ZOOL. 106 THE GENETIC SYSTEM. (3)

Second semester. Three lectures a week. Prerequisites, a course in genetics, one year of organic chemistry and Math. 11 or equivalent. A detailed description of the interactions of the genetic system. (Keller.)

ZOOL. 108. ANIMAL HISTOLOGY. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. A microscopic study of tissues and organs of verterates with special emphasis on the mammal. Practice in elementary histotechnique will be included. (Schmittner.)

ZOOL. 109. ANIMAL CYTOLOGY. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, two years of zoology and organic chemistry, or permission of the instructor. A study of cellular structure with particular reference to the morphology and physiology of cell organoids and inclusions. (Brown.)

ZOOL. 110. GENERAL PARASITOLOGY. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, two years of zoology and one year of chemistry, or permission of the instructor. A consideration of the phenomenom of parasitism through a study of the structure, function and host relationships of parasitic organisms. (Jachowski.)

ZOOL. 118. INVERTEBRATE ZOOLOGY. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. An advanced course dealing with the phylogeny morphology and embryology of the invertebrates, exclusive of insects. (Linder.)

Zool. 120. Vertebrate Embryology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. Principles of developmental dynamics including organization, differentiation, morphogenesis and developmental physiology. (Ramm.)

Zool. 121. Animal Ecology. (3)

Second semester. Two lectures and one three hour laboratory period a week. Prerequisite, one year of zoology. The environment and its control of animal abundance, organization of populations, and the biology of communities will be studied. (Stross.)

Zool. 127. Ichthyology. (4)

Second semester. Two lectures and one two-hour and one three-hour laboratory period a week. Prerequisites, Zool. 1, 2 and 5 or equivalent. A course in anatomy, embryology, distribution, habits and taxonomy of marine and fresh water fish. (Nelson.)

Zool. 128. Zoogeography. (3)

First semester. Three lectures a week. Prerequisites, Zool. 1, 2, and 5 or equivalent. Principles governing the geographical distribution of animals with particular emphasis on vertebrates. (Highton.)

Zool. 129. Vertebrate Zoology. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, two years of zoology or permission of instructor. The identification, classification, habits and behavior of vertebrates. (Ficken.)

Zool. 130. Hydrobiology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of biology or permission of instructor. Study of aquatic animals and conditions of existence in water. Selected examples are used to illustrate the influence of environment on productivity of aquatic communities. (Stross.)

Zool. 150. Special Problems in Zoology. (1 or 2)

Prerequisites, major in zoology or biological sciences, a minimum of 3.0 cumulative average in the biological sciences, and consent of instructor. Research or integrated reading in zoology. A student may register several times and receive up to 8 semester hours of credit. (Staff.)

Zool. 151H. Honors Seminar. (1)

First and second semesters. One discussion period a week. Prerequisite, participation in honors program. Guided discussion of topics of current interest. Repeatable to total of 4 hours credit. (Staff.)

Zool. 152H. Honors Independent Study. (1-4)

Prerequisite, participation in honors program. Study of classical material by way of guided independent study and laboratory experiments. Repeatable to a total of 12 hours credit. (Staff.)

ZOOL. 153H. HONORS RESEARCH. (1-2)

Prerequisite, participation in honors program. A laboratory research problem which is required each semester during honors participation and culminates in an honors thesis. Repeatable to a total of 8 hours credit. (Staff.)

ZOOL. 182. ETHOLOGY. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisites, two years of zoology, including a course in compartive anatomy, or permission of instructor. The function, causation, and evolution of behavior. Laboratory analysis of the behavior of several species. (Ficken.)

ZOOL. 190. EVOLUTION. (3)

First semester. Three lectures a week. Prerequisite, a course in genetics or permission of instructor. A consideration of current thought in regard to the origin and evolution of living organisms. (Crenshaw.)

For Graduates

ZOOL. 201. COMPARATIVE PHYSIOLOGY. (4)

Second semester. Three lectures and one three-hour laboratory period a week. Prerequisites, one year of zoology, one year of organic chemistry and one semester of physiology. The study of the differences and similarities in the functioning of organs of species of the animal kingdom. (Brinkley.)

ZOOL. 203. ADVANCED EMBRYOLOGY. (4)

First semester. Two lectures and four hours of laboratory a week. Prerequisites, a course in embryology and a course in physiology. The biochemical basis of development. (Ramm.)

ZOOL. 204. CELLULAR PHYSIOLOGY. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, a course in physiology and one year of organic chemistry. The principles of general and cellular physiology as found in animal life. (Schoenborn.)

ZOOL. 205. COMPARATAVE INVERTEBRATE ENDOCRINOLOGY (3)

Second semester. Three lectures a week. Prerequisites, one year of organic chemistry, a course in endocrinology and a course in physiology, or permission of the instructor. A systematic approach to the structure and physiology of neuro-endocrine systems of invertebrates. (Linder.)

ZOOL. 206. ELECTROPHYSIOLOGY. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, a course in physiology, one year of physics, and permission of the instructor. A course concerned with electrical phenomena occurring in living matter and with the effect of electrical current on cells, with special emphasis on nerves and muscles. (Gainer.)

ZOOL. 207. ZOOLOGY SEMINAR. (ARRANGED)

One seminar a week for each credit hour. 1. cytology; 2. embryology; 3. fisheries; 4. genetics; 5. parasitology; 6. physiology; 7. systematics; 8. ecology; 9. behavior; 10. recent advances; and 11. endocrinology. (Staff.)

Zool. 208. Special Problems in Zoology. (Arranged)

1. cytology; 2. embryology; 3. fisheries; 4. genetics; 5. parasitology; 6. physiology; 7. systematics; 8. ecology; 9. behavior; 10. general; and 11. endocrinology.
(Staff.)

Zool. 210. Systematic Zoology. (4)

First semester. Three lectures and one three-hour laboratory period a week. The principles and methods involved in the classification of animals, with emphasis on population dynamics and speciation. Methods of evaluating taxonomic data, principles of zoological nomenclature, field and museum techniques, and the factors influencing the distribution of animals are also stressed.
(Highton.)

Zool. 211, 212. Lectures in Zoology. (1-3, 1-3)

First and second semesters. One, two, or three lectures a week. Advanced lectures by outstanding authorities in their particular field of zoology. As the subject matter is continually changing, a student may register several times, receiving credit for several semesters. (Visiting Lecturers.)

Zool. 215. Sociobiology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, a course in behavior and permission of the instructor. The course will deal with the description and analysis of animal social organizations, the adaptive nature of animal societies, the effects of early experience, and the role of communication in the integration of animal groups. (Eisenberg.)

Zool. 216. Physiological Cytology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of biochemistry and physics, a course in physiology, or permission of the instructor. A study of the structure and function of cells by chemical, physical and microscopic methods. (Brown.)

Zool. 220. Population Genetics. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, a course in genetics. The role of mutation, selection, migration, inbreeding, and stochastic process in evolution. (Highton.)

Zool. 223. Analysis of Animal Structure. (4)

First semester. Two lectures and four hours of laboratory a week. Prerequisite, a course in embryology. The experimental basis of developmental mechanics.
(Ramm.)

Zool. 234. Experimental Mammalian Physiology. (4)

First semester. Two four-hour laboratory periods a week. Prerequisites, a course in physiology and one year of chemistry above general chemistry. The theory, use and application to research of instrumentation normally found in the physiology laboratory with an introduction to surgical techniques on both large and small animals. (Grollman.)

Zool. 235. Comparative Behavior. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, usually a course in behavior and one in physiology, and permission of the instructor. Orientation and migration, communication, coding, brain and behavior, biological rhythms, and hormones and behavior are the main subjects that will be considered. (Staff.)

Zool. 236. Mammalian Physiology. (3)

Three lectures a week. Prerequisite, a course in physiology. Advanced study of the functioning of the organs of mammalian species. (Staff.)

Zool. 237. Comparative Vertebrate Endocrinology. (3)

Second semester. Three lectures each week. Prerequisite. one semester of biochemistry, physiology and endocrinology. Study of the difference and similarities in the structure and functioning of the endocrine organs of the vertebrate species. (Brinkley.)

Zool. 240. Analysis of Animal Populations. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, a course in ecology or permission of instructor. An advanced course in animal ecology with a focus on population. Studies of growth and regulation of animal populations are emphasized. (Stross.)

Zool. 245. Biology of Birds. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, a course in vertebrate zoology or permission of instructor. Emphasis will be on ecology, behavior, anatomy, systematics, and reproductive physiology, plus field studies of local birds. (Ficken.)

Zool. 250. Experimental Parasitology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, a course in parasitology and permission of the instructor. Experiments will be performed utilizing living parasites in laboratory animals to illustrate various aspects of the host-parasite relationship. (Jachowski.)

Zool. 251. Helminthology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, two years of zoology and permission of the instructor. A study of the classification, structure and biology of the helminths. (Staff.)

Zool. 252. Protozoology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of zoology and permission of the instructor. A study of the classification, structure and biology of the protozoa. (Staff.)

Zool. 253. Physiology of Symbiosis. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of biochemistry and permission of instructor. A consideration of the biology of symbiotic organisms, especially the physiological concert existing between host and symbiont. (Staff.)

Zool. 260. Quantitative Zoology. (4)

First semester. Three lectures and one three-hour laboratory period a week. Prerequisites, Math. 19 or equivalent and permission of the instructor. A consideration of the statistical techniques of principal importance in the analysis of biological data. (Keller.)

Zool. 300. Advanced Topics in Parasitology. (Arranged)

Prerequisites, advanced graduate standing and permission of the instructor. The content of the course changes frequently and students may register for it several times. The course will consist of critical discussions of the published literature and current problems in parasitology. 1. host-parasite relationships; 2. ecology of parasites; 3. immunity to parasites; and 4. physiology of parasites. (Staff.)

Zool. 399. Research. (Arranged)

Work on thesis project only. 1. cytology; 2. embryology; 3. fisheries; 4. genetics; 5. parasitology; 6. physiology; 7. systematics; 8. ecology; 9. behavior; 10. invertebrate zoology; and 11. endocrinology. (Staff.)

SCHOOL OF DENTISTRY

ANATOMY

Professors: Hahn and Piavis

Lecturer: Lindenberg

For Graduates and Advanced Undergraduates

Anat. 111. Human Gross Anatomy. (8)

First semester. Two lectures and three laboratories a week. Second semester. Two lectures and two laboratory periods for eight weeks. This course consists of dissections and lectures supplemented by frequent conferences and practical demonstrations. The entire human body is dissected. The subject is taught with the purpose of emphasizing the principles of the body structure, the knowledge of which is derived from a study of its development, its organs and tissues and the action of its parts. (Hahn, Piavis, Staff.)

Anat. 112. Human Neuroanatomy. (2)

Second semester. Two lectures and two laboratory periods for eight weeks. Prerequisite, Anat. 111 or equivalent. The work consists of a study of the brain and spinal cord by gross dissections and microscopic methods. Correlation is made, whenever possible, with the student's work in the histology and physiology of the central nervous system. (Hahn, Piavis, Lindenberg, Staff.)

For Graduates

Anat. 211. Human Gross Anatomy. (8)

Same as Anat. 111 but with additional work on a more advanced level. (Hahn, Piavis, Staff.)

Anat. 212. Human Neuroanatomy. (2)

Same as Anat. 112 but with additional instruction of a more advanced nature. (Hahn, Piavis, Lindenberg, Staff.)

ANAT. 214. THE ANATOMY OF THE HEAD AND NECK. (3)

One conference and two laboratory periods per week for one semester. This course is designed to provide the student with a detailed study of the basic anatomy of the region and to correlate this knowledge with the various aspects of clinical practice. (Hahn, Piavis.)

ANAT. 399. RESEARCH.

(Credit determined by amount and quality of work performed.) (Staff.)

BIOCHEMISTRY

Assistant Professors: LEONARD AND MORRIS.

BIOCHEM. 111. PRINCIPLES OF BIOCHEMISTRY. (6)

Prerequisites, inorganic and organic chemistry, with additional training in quantitative and physical chemistry desirable. Two lectures and one laboratory period a week throughout the year, with one conference period per week during the first eight weeks of Semester 1. T he chemistry of living matter forms the basis of the course. The detailed subject matter includes the chemistry of carbohydrates, fats, proteins, enzymes, vitamins, and hormones. The processes of respiration, digestion, metabolism, secretion and excretion are considered. Laboratory instruction in qualitative blood and urine examination is included. (Leonard, Morris.)

For Graduates

BIOCHEM. 211. ADVANCED BIOCHEMISTRY. (6)

This course is the same as Biochem. 111 except that it includes additional instruction, collateral reading and assigned reports of an advanced nature. (Leonard, Morris.)

BIOCHEM. 399. RESEARCH.

(Number of hours and credit by arrangeemnt.) (Leonard, Morris.)

HISTOLOGY

Professor: PROVENZA.

Assistant Professors: BARRY AND FISCHLSCHWEIGER.

Instructor: SEIPP.

HISTOL. 111. MAMMALIAN HISTOLOGY AND EMBRYOLOGY. (8)

First year. The course embraces the thorough study of the cells, tissues and organs of the various systems of the human body. Although certain aspects of the dental histology phase of the course are given strictly as special entities, many are included in the instruction in general histology, since the two areas are so intimately related when functional and clinical applications are considered. The instruction in embryology is correlated with that in histology. It covers the fundamentals of development of the human body, particular emphasis being

given to the head and facial regions, the oral cavity, and the teeth and their adnexa. Specific correlations are also made with the other courses in the dental curriculum. (Provenza, Barry, Seipp.)

For Graduates

HISTOL. 212. MAMMALIAN HISTOLOGY AND EMBRYOLOGY. (4-2)

This course is the same as Hist. 111, except that it does not include the dental phases of Histol. 111, but does include additional instruction and collateral reading of an advanced nature. (Provenza, Barry, Seipp.)

HISTOL. 213. MAMMALIAN ORAL HISTOLOGY AND EMBRYOLOGY. (2)

Prerequisite, Histol. 111 or 212, or an equivalent course. This course covers the dental aspects of Histol. 111, and includes additional instruction in the relations of histologic structure and embryologic development of the teeth, their adnexa, and the head and facial regions of the human body. (Provenza, Barry, Seipp.)

HISTOL. 216. INHERITANCE AND DEVELOPMENT BIOLOGY. (6)

This course is concerned with the study of the embryogeny and fetal developments of vertebrate animals with special emphasis on mammalian embryology. In addition to tracing the development pattern, lectures are devoted to the discussion of inheritance mechanisms, gametogenesis and fertilization. (Provenza.)

HISTOL. 217. COMPARATIVE ANIMAL HISTOLOGY. (6)

Prerequisite, Histol. 111, 212-213, or an equivalent course. This course is concerned with a comparative study of the morphology, structure and function of the cells, tissues and organs as found in representative members of the animal kingdom. Special emphasis is placed on techniques and research methods. (Provenza.)

HISTOL. 218. EXPERIMENTAL EMBRYOLOGY. (4)

Second semester of every year. Prerequisite, Histol. 216, or an equivalent course. This course is concerned with the historical and recent aspects of experimental embryology from both the applied and theoretical standpoint. Each student will be assigned a special problem in addition to the scheduled lectures. (Provenza.)

HISTOL. 219. RADIATION BIOLOGY. (4)

First semester of odd numbered years. The primary aim of this course is to familiarize the student with the techniques of handling radioactive isotopes as applied in biological research. The topics covered in the course are: the physics of radioactivity from the standpoint of the biological researcher; the selection of isotopes for specific investigations; the effects of radioactivity on cells, tissues and systems; the effect of radioactivity on inheritance; the role of environment on the effectiveness of radioactivity; and certain phases of laboratory health physics. The laboratory will be concerned with the use and location as well as recording and interpreting data of isotopes as applied to biological research. (Barry.)

HISTOL. 220. PHYSICAL METHODS IN HISTOLOGY. (4)

Second semester of even numbered years. The course introduces the graduate student to some of the more frequently employed techniques in cytological and

histological research. Exercises are designed for the operation and interpretation of data derived from the use of available research tools. Two one-hour lectures and one four-hour laboratory period per week. Consent of department head required. (Barry.)

HISTOL. 320. SEMINAR. (1, 1)

(Staff.)

HISTOL. 399. RESEARCH.

(Number of hours and credit by arrangement.) (Provenza, Barry.)

MICROBIOLOGY

Professor: SHAY.

Assistant Professor: KRYWOLAP.

Instructor: BECKER.

For Graduates and Advanced Undergraduates

MICROB. 115. SEROLOGY AND IMMUNOLOGY. (4)

Second semester. Two lectures and two laboratory periods a week. Protective reactions of the animal body against pathogenic microorganisms and their products; cellular and humoral immunity; anaphylaxis and allergies. (Shay, Becker, Krywolap.)

MICROB. 121. DENTAL MICROBIOLOGY AND IMMUNOLOGY. (4)

First semester. Consideration is given to pathogenic bacteria, viruses, yeasts and molds. Special attention is given to those organisms which produce lesions of the oral cavity. Immunological principles are studied with emphasis on hypersensitivity resulting from antibiotics, antigens and vaccines. Laboratory teaching includes cultural characteristics, disinfection, sterilization, asepsis, animal inoculation, antibiotics assay and virus techniques. In all phases of the course emphasis is placed on dental applications. (Shay.)

For Graduates

MICROB. 200, 201. CHEMOTHERAPY. (1, 1)

Offered in alternate years. Prerequisites, Microb. 121 or equivalent, Biochem. 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs employed in the treatment of disease. (Shay.)

MICROB. 202, 203. REAGENTS AND MEDIA. (1, 1)

Offered in alternate years. Consideration of media for special procedures, such as, antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements on specific groups of microorganisms. (Shay.)

MICROB. 210. SPECIAL PROBLEMS IN MICROBIOLOGY.

(Credit determined by amount and quality of work performed.) Laboratory course. Special studies in the various divisions of microbiology. (Shay.)

MICROB. 211. PUBLIC HEALTH. (2)

Prerequisite, Microb. 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The application of statistical and epidemiological methods to health problems is illustrated through lectures and demonstrations. (Shay.)

MICROB. 212. BACTERIAL FERMENTATIONS. (2)

Prerequisite, Biochemistry III or an equivalent course and Microb. 121 or an equivalent course. Second semester alternate years. This course covers composition, nutrition and growth of microorganisms; influence of physical and chemical environment on metabolism; chemical activities of microorganisms; mechanisms of fermentative and oxidative metabolism. (Krywolap.)

MICROB. 221. ADVANCED DENTAL MICROBIOLOGY AND IMMUNOLOGY. (4)

Prerequisite, Microb. 121 or equivalent. First semester. Three lecture hours and three hours of laboratory with group conferences each week. This course, intended for graduate students of oral microbiology, is a continuation of Microbiol. 121, supplemented with library readings and advanced laboratory experimentation. (Shay, Becker, Krywolap.)

MICROB. 224. MICROBIOLOGY OF THE PERIODONTIUM. (2)

Prerequisite, Microb. 121, Histology 111, and Pathology 121 or equivalents. Second semester alternate years. This course is designed for advanced students in the field of oral microbiology. Consideration will be given to the role of microorganisms in periodontal tissues and the factors that influence the development of diseases: bacterial interactions; parasitism; salivary calculus; periodontitis; gingivitis and herpetic gingivostomatitis. (Shay.)

MICROBIOLOGY 281-283. SEMINAR. (1) (1)

Presentation and discussion of current literature and research in the field of microbiology. (Shay.)

MICROB. 399. THESIS RESEARCH.

(Credit determined by amount and quality of work performed.) Open only to candidates for advanced degrees in microbiology. (Shay.)

ORAL SURGERY

Professor: DORSEY.

For Graduates

SURG. 201. CLINICAL ANESTHESIOLOGY. (6)

Forty hours a week for thirteen weeks. (Heldrich, Staff.)

SURG. 220. GENERAL DENTAL ORAL SURGERY. (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

SURG. 221. ADVANCED ORAL SURGERY. (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

SURG. 399. RESEARCH.
Time and credit by arrangement. (Staff.)

PATHOLOGY

Professors: J. J. SALLEY AND M. LUNIN.

Assistant Professor: B. BURCH.

Instructor: F. STOUT.

For Graduates and Advanced Undergraduates

PATH. 121. GENERAL PATHOLOGY. (4)
Two lectures and two laboratory periods per week for one semester.
(M. Lunin and Staff.)

For Graduates

PATH. 212, 213. (2, 2)
Prerequisite, Pathology 121 or equivalent. One lecture and one laboratory period per week. The histopathology of selected oral lesions with emphasis on recent advances in diagnostic techniques.
(J. J. Salley, M. Lunin, B. Burch.)

PATH. 214, 215. (4, 4)
Prerequisite, Pathology 121 or equivalent. Two four hour laboratory periods each week. The laboratory methods used in preparing pathologic tissues for microscopic examination. (Staff.)

PATH. 216, 217. ADVANCED HISTOPATHOLOGY OF ORAL LESIONS. (3, 3)
Prerequisite, Pathology 212 or equivalent. One hour of lecture and four hours of laboratory each week. The study of uncommon and rare lesions of the head and neck. (M. Lunin, B. Burch.)

PATH. 218, 219. SEMINAR. (1, 1)
Prerequisite, Pathology 121 or equivalent. One period each week. Recent advances in experimental pathology. (M. Lunin.)

PATH. 399. RESEARCH.
Time and credit by arrangement. (Staff.)

PHYSIOLOGY

Professor: WHITE.

Associate Professor: SHIPLEY.

Assistant Professor: WEATHERRED.

PHYSIOLOGY 121. PRINCIPLES OF PHYSIOLOGY. (4, 2)
Three lectures and one laboratory period per week, first semester; two lectures per week, second semester. The lectures cover the major areas of physiology,

including the central and peripheral nervous systems, muscle, heart and circulation, respiration, renal function, digestion, endocrines and reproduction. The laboratory includes experiments with the turtle heart and frog nerve-muscle preparations, mammalian operative work and observations on the human subject. (White, Staff.)

PHYSIOLOGY 211. PRINCIPLES OF MAMMALIAN PHYSIOLOGY. (4, 2)

Prerequisite, permission from the Department. Same as Physiology 121 but with collateral reading and additional instruction. Each student is required to write a review paper on some special phase of physiology. (White.)

PHYSIOLOGY 212. ADVANCED PHYSIOLOGY.

Hours and credit by arrangement. Prerequisite, Physiology 121 or its equivalent. Lectures and seminars on special problems and recent advances in physiology during the second semester. (White.)

PHYSIOLOGY 213. RESEARCH.

By arrangement with the Head of the Department. (White.)

PHYSIOLOGY 399. THESIS RESEARCH.

By arrangement with the Head of the Department. (White.)

SCHOOL OF MEDICINE

ANATOMY

Professors: FIGGE, KRAHL, AND LEVEQUE.

Assistant Professors: CRISPENS, WELLS, RAMSAY, WADSWORTH, EBNER, AND AQUINO.

The graduate degrees offered by the Department of Anatomy are the Master of Science and the Doctor of Philosophy.

For Graduates and Advanced Undergraduates

ANAT. 201. GENERAL ANATOMY OF THE HUMAN BODY. (9)

Four conferences or lectures and 12 laboratory hours per week throughout the first semester. This course gives the student an opportunity to develop a basic concept of the morphology of the human body. It is closely interwoven with the study of neuroanatomy, histology and embryology, and some time is devoted to roentgen anatomy. The entire human body is dissected. Laboratory fee, $25.00. (Figge, Krahl, Mech, Ramsay, Wadsworth.)

ANAT. 206. CORRELATIVE ANATOMY. (1)

Patients will be demonstrated and the anatomical features of the case will be stressed to give the student a concept of the relationship of the anatomy to clinical subjects.

ANAT. 207. FETAL AND INFANT ANATOMY. (2)

Second semester. Fifteen periods of three hours each, every Thursday from 2 p.m. to 5 p.m. for 15 weeks. This course is open to graduate students and post-graduates interested in pediatrics. Laboratory fee, $10.00. (Krahl.)

ANAT. 399. RESEARCH IN ANATOMY.

Maximum credits, 12 per semester. Research work may be taken in any one of the branches of anatomy. (Figge, Staff.)

MICROANATOMY

MICROANAT. 202. MICROANATOMY. (6)

Three lectures and six laboratory hours a week for 16 weeks. This course presents an integrated study on an advanced level of the histology and embryology of the human body. An attempt is made to correlate this with gross anatomy as well as other subjects in the medical curriculum. Special emphasis is placed on the dynamic and functional aspects of the subject. Laboratory fee, $15.00. (Figge, Leveque, Staff.)

MICROANAT. 205. GENETICS. (2)

This course consists of a series of one-hour lectures which include a consideration of the principles of genetics, population genetics, biochemical genetics, radiation genetics, immunogenetics, and microbial genetics. Special emphasis is placed on the importance, understanding and application of genetics to health and disease. (Crispens.)

MICROANAT. 208. NORMAL AND ATYPICAL GROWTH. (2)

Lectures in problems of growth. Two hours per week, time to be arranged. Sixteen weeks. (Figge.)

MICROANAT. 209. MORPHOLOGICAL MICRO-TECHNIQUES. (2)

One lecture and two laboratory hours a week for one semester. The aim of this course is to study the theoretical and practical applications of a variety of microanatomical techniques and their utilization in research. Time to be arranged. (Leveque.)

MICROANAT. 399. RESEARCH.

Maximum credits, 12. Research work may be taken in any one of the branches which form the subject of microanatomy (including cancer research.)
(Figge, Leveque, Crispens.)

NEUROANATOMY

NEUROANAT. 203. HUMAN NEUROANATOMY. (4)

Two lectures and four laboratory hours per week for 17 weeks. The study of the detailed anatomy of the central nervous system is coordinated with structure and functions of the entire nervous system. The dissection of the human brain and the examination of stained microscopic sections of various levels of the brain stem are required. Laboratory fee, $15.00.
(Ebner, Figge, Wells, Staff.)

Neuroanat. 210. Special Problems in Neuroanatomy. (2)

This course will deal with specific problems in the field of neuro-anatomy, depending on the interests of the sponsor. It will consist of lectures, seminars and specific laboratory assignments. (Figge, Wells, Ebner.)

Neuroanat. 399. Research in Neuroanatomy.

Maximum credits, 12. Research work involving the central or peripheral nervous system. (Ebner, Figge, Wells, Staff.)

INTERDEPARTMENTAL COURSES

ID. 101. Man and His Environment. (2)

One-hour lecture and one-hour panel discussion Saturday mornings from 9 to 11 a.m. throughout the year. Distinguished leaders in American medicine participate in the presentation of these weekly sessions. The course is broad in scope, stressing the cultural aspects of anthropology with emphasis directed toward the sociological, psychological, physiological, and geneological relationships of man and his surroundings. All departments of the School of Medicine participate.

P.M. 101. Biostatistics. (1)

(Staff.)

BIOLOGICAL CHEMISTRY

Professors: Adams and Bessman (P.T.).

Associate Professors: Emery, Pomerantz, and Stevens.

Assistant Professors: Bode, Layne (P.T.), and Ganis (P.T.)

Instructors: Brown, Gryder, and Rosso.

Graduate degree offered by the Department of Biological Chemistry is the Doctor of Philosophy.

For Graduates

Biochem. 201. Principles of Biochemistry. (8)

First year, second semester. A general introduction to biochemistry with emphasis on basic chemistry of biologically important molecules, enzymes, intermediary metabolism, matabolic regulation, and molecular biology. Features of mammalian biochemistry are stressed but general and comparative aspects are considered.

Biochemistry 202, 203. Special Topics in Biochemistry. (2, 2)

A series of lectures on topics of current interests in biochemistry. Coverage varies from year to year. Subjects reviewed in 1964-65 included nucleic acid biochemistry, chromosomal structure, oxygenases, collagen structure and metabolism, peptide hormones, hemoglobin. Prerequisite, Biochemistry 201.

BIOCHEMISTRY 204, 205. SEMINAR. (1, 1)

Reports on current literature or on research in progress. Prerequisite, Biochemistry 201.

BIOCHEMISTRY 399. RESEARCH. (Maximum credits, 12 hours per semester.)

(Additional offerings are contemplated for 1965-6 and later years and will be announced as offered.)

BIOPHYSICS

Professors: MULLINS AND SJODIN.

Associate Professor: STERN.

Assistant Professor: HYBL.

The Department of Biophysics offers graduate courses of study leading to the degrees of Master of Science and Doctor of Philosophy. The study programs are flexible and depend on the preparation and interests of the student. Detailed requirements are available from the Department of Biophysics (c/o School of Medicine, Baltimore).

It is recommended that students studying for the degree of Doctor of Philosophy in Biophysics select a minor in either physics, chemistry, or mathematics.

For Graduates and Advanced Undergraduates

BIOPHYS. 100, 101. INTRODUCTION TO BIOPHYSICS. (3-3)

Fall semester, odd years; Spring semester, even years. Three lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11. Math. 18, 19. An introduction to the study of living systems applying the methods of physics and chemistry. The cell as a physico-chemical system and experimental methods for investigation, nerve impulse conduction and excitation, the interaction of radiation with living material; the structure and properties of muscle tissue, connective tissue, and their proteins. (Staff.)

BIOPHYS. 102. BIOPHYSICS OF RADIATION. (2)

Fall semester, even years. Two lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11. An advanced study of the interaction of radiation with living matter and with molecules of biological interest. Dosimetry problems and some bio-medical applications will be considered. (Mullins, Sjodin, Robinson.)

BIOPHYS. 103. LABORATORY TECHNIQUES IN BIOPHYSICS. (3)

Fall semester, 1967-68. One lecture and two laboratory periods a week. Prerequisites, Biophys. 100, 101, or consent of the staff. Training in the use of radioactive isotopes, radio-active counting equipment, and bio-electric measuring instruments applied to the study of membranes; viscosity, optical rotation, protein titrations, spectroscopy, conductivity, as applied to fiber forming proteins. Laboratory fee, $20.00. (Staff.)

Biophys. 104. Seminar in Biophysics. (1)

Prerequisites, Biophys. 100, 101, or consent of the staff. Seminars on various biophysical topics given by the staff, graduate students, and guest speakers. (Staff.)

For Graduates

Biophys. 200. Advanced and Theoretical Biophysics. (3)

Fall semester, odd years. Three lectures a week. Prerequisites, Biophys. 100, 101, or consent of staff. An advanced and critical analysis of experimental findings in terms of biophysical theory. (Staff.)

Biophys. 201. Membrane Biophysics. (2)

Two lectures a week. Prerequisites, Chem. 1, 3, Phys. 10, 11, Math. 20, 21. Diffusion in and through membranes developed from first principles with special reference to problems of ion transport in biological membranes. (Sjodin.)

Biophys. 202. Biophysical Chemistry. (3)

Three lectures a week. Prerequisites, Physical Chemistry, Differential and Integral Calculus. The application of physico-chemical theory to the methods used to study the properties or proteins, nucleic acids, and other macromolecules and their component parts, and the properties of the fibers and other biological fabrics derived from these macromolecules. The properties of interest will include molecular weight, size, shape and charge, intramolecular configuration, and inter-molecular interaction. The methods of interest will include light scattering, ultracentrifuge, viscosity and other hydrodynamic methods, optical rotation and rotary dispersion. (Stern.)

Biophys. 203. X-ray Crystallography. (3)

Three lectures a week. An introduction to molecular structure determination by the techniques of X-ray differaction. Emphasis upon problems arising in structural studies of molecules of biological origin. (Hybl.)

Biophys. 205. Colloquium in Biophysics. (1)

Prerequisites, Biophys. 104 or consent of the staff. Colloquia on various biophysical topics given by the staff, graduate students and guest speakers. (Staff.)

Biophys. 399. Research in Biophysics. (3-6)

Required of students planning to take the Master of Science degree or the Doctor of Philosophy degree in Biophysics. (Staff.)

FELLOWSHIPS AND ASSISTANTSHIPS

A limited number of departmental fellowships and research assistantships are available in the Department of Biophysics. Inquiries should be directed to the department; deadline for applications is March 1.

MICROBIOLOGY

Professors: Wisseman, Traub.

Associate Professors: Eylar, Fiset, and Smith.

Assistant Professors: Myers, Rosenzweig, and Snyder.

The Department of Microbiology offers the degree of Doctor of Philosophy. While the degree of Master of Science may be offered in special instances, priority for research facilities will be given aspirants to the Ph.D. degree. This Department encourages students who wish to enroll in the combined M.D.-Ph.D. program.

Emphasis is placed upon medical aspects of microbiology. Research programs are available in virology, rickettsiology, medical bacteriology and mycology, microbial physiology. Opportunities are open for experience in teaching and in diagnostic bacteriology and serology. Opportunities exist for ecological studies on rickettsioses and arboviruses in overseas areas.

For Graduates and Advanced Undergraduates

Microb. 101. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, $10.00. This course begins with an introduction to basic principles of microbiology and immunology and then proceeds to consider the major groups of bacteria, spirochetes, fungi, rickettsiae and viruses that cause human disease. Emphasis is placed upon an analysis of the properties of microorganisms thought to be important in disease production, pathogenesis of infection and interaction with host defense mechanisms, epidemiology and control measures. (Wisseman, Staff.)

For Graduates

Microb. 201. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, $10.00. This course, intended for the serious advanced student of medical microbiology, is built upon the framework of Microb. 101 supplemented with advanced readings and laboratory work. (Wisseman, Staff.)

Microb. 203. Microbial Physiology. (3)

Second semester, alternate years. Three lectures per week supplemented with demonstrations. By consent of instructor. This course surveys the metabolic processes of bacteria, fungi, rickettsiae, viruses and parasitic protozoa. (Myers, Wisseman.)

Microb. 206, 207. Seminar. (1, 1)

First and second semesters. One session per week. Graduate students, staff and guests participate in comprehensive and critical reviews of subjects of special interest or pertinent to graduate training program. (Wisseman, Staff.)

Microb. 208. Medical Mycology. (2)

Second semester, alternate years. One lecture and one laboratory per week. Laboratory fee, $10.00. Registration by consent of instructor. Consists of a review of the fundamentals of elementary mycology; a consideration of methods for the isolation, cultivation and identification of actinomycetes, yeasts and fungi; and a study of the etiological agents and of the immunology, epidemiology, prognosis and treatment of the medical mycoses. (Smith.)

Microb. 209. Special Topics.

(Permission and credit arranged individually.) This course provides the opportunity for the graduate student to pursue under supervision subjects of special interest not offered in other formal courses. A study program is worked out with the instructor prior to registration and may consist of special readings, conferences, reports and, on occasion, laboratory experience. (Wisseman, Staff.)

Microb. 210. Advanced Virology and Rickettsiology Lecture. (3)

This course considers the general properties of viruses and rickettsiae, methods for studying them and finally concentrates on agents of medical importance. Special emphasis is placed on the host-parasite relationship, characterization of the various viral and rickettsial agents and on biological and ecological factors. Registration is by permission of instructor only. The course will be given as the average on alternate years in the Spring semester. There are two weekly sessions of 90 minutes each. Prerequisites: Microb. 201 or equivalent.
(Eyler, Fiset, Wisseman, Staff.)

Microb. 211. Virology and Rickettsiology Laboratory. (1)

This course is the laboratory counterpart of Microbiology 210. It is designed to familiarize the student with the major techniques for the study of virus and rickettsial agents and to give him first hand experience with a variety of the more common agents. Registration is by permission of instructor only. Because of the limited facilities and the nature of the work, it may be necessary to restrict registration in this course according to the following priority: students majoring in medical microbiology, then students minoring in microbiology and, finally, others. The laboratory consists of one formal session per week; however, the nature of the work frequently requires additional participation throughout the week. (Eyler, Fiset, Wisseman, Staff.)

Microb. 399. Research.

Maximum credits, 12 hours per semester. (Wisseman, Staff.)

LEGAL MEDICINE

Professor: Fisher.
Associate Professor: Freimuth.
Assistant Professor: Petty.

Leg. Med. 201. Legal Medicine. (1)

One hour of lecture for twelve weeks, 4 hours assigned reading. This course embraces a summary of medical jurisprudence including the laws governing the practice of medicine, industrial compensation and malpractice, proceedings in criminal and civil prosecution, medical evidence and testimony, including medicolegal toxicology. (12 hours) (Fisher, Freimuth, Petty.)

Leg. Med. 202. Toxicology. (10)

Two hours lecture, 8 laboratory hours per week for 1 year. There is also included some discussion of industrial toxicology relating industrial exposures to toxic substances to effects produced in the worker using these materials. The lectures include discussion of mechanism of action of poisons, lethal doses, antidotes and methods of detection and quantitation of poisons in tissues and body fluids. The laboratory work embraces practical application of analytical procedures for the detection and estimation of poisons in post mortem tissue samples.

(Fisher, Freimuth.)

Leg. Med. 203. Gross Pathologic Anatomy as Related to Toxicology. (2)

Two hours per week for one year. This course includes elementary anatomy with normal histology and selected histopathology as it will be seen by the toxicologist. It is a correlated course embracing anatomy, basic physiology and the alterations in function as well as structure brought about by disease and poisoning.

(Fisher, Petty.)

Leg. Med. 399. Research in Toxicology.

(Number of hours and credit arranged.) (Fisher, Freimuth.)

This Department offers schedules leading to the degrees of Master of Science and Doctor of Philosophy in toxicology. Candidates are expected to have completed undergraduate work as follows: Eight semester hours each in general chemistry, organic chemistry, analytical chemistry (qualitative and quantitative), physical chemistry, physics, biology and four semester hours in organic qualitative analysis.

Candidates for the Master's degree must complete the following or equivalent courses:

Leg. Med. 201, 202, 203 and 399.
Pharm. 101 f. s., and Chem. 258.

Candidates for the doctorate must complete the following or equivalent courses:

Leg. Med. 201, 202, 203, 399.
Pharm. 100 f. s., Physiol. 102, Bact. 101, Bact. 102,
Biochem. 206, Chem. 206, 208, Chem. 221, 223, Chem. 258,
Chem. 150, Pharm. Chem. 111, 113, Pharm. Chem. 112, 114.

Part of the above work is offered at College Park with the remainder to be done at the Baltimore Schools. Some of the course work in legal medicine and toxicology will be given at the laboratories of the Division of Forensic Pathology located at the Office of the Chief Medical Examiner, 700 Fleet Street, Baltimore, Maryland.

PHARMACOLOGY

Professors: Burgison and Truitt.

Associate Professors: O'Neill and Bryant.

Assistant Professors: Musser, Cascorbi, Rudo, Rozman, and S. Fox.

All students majoring in the Department of Pharmacology with a view to obtaining the degree of Master of Science or Doctor of Philosophy should secure special training in anatomy, mammalian physiology, organic chemistry, and physical chemistry.

For Graduates and Advanced Undergraduates

Pharmacol. 101, f.s. General Pharmacology. (8)

Three lectures and one laboratory. This course consists of 105 lectures and 32 laboratory periods of three hours each, offered each year. Laboratory fee, $20.00.

(Bryant, Burgison, Cascorbi, Musser, O'Neill, Rozman, Truitt, Rudo.)

For Graduates

Pharmacol. 201, f.s. General Pharmacology. (8)

Same as Pharmacol. 101, for students majoring in pharmacology. Additional instruction and collateral reading are required. Laboratory fee. $20.00

(Krantz, Bryant, Burgison, Cascorbi, O'Neill, Rozman, Truitt, Rudo, and Fox.)

Pharmacol. 206, f.s. Pharmacologic Methodology. (4)

Prerequisite, Pharmacol. 201, f.s. (Truitt.)

Pharmacol. 207, 208. Chemical Aspects of Pharmacodynamics. (2, 2)

(Burgison.)

Pharmacol. 209. Biochemical Pharmacology. (2)

(O'Neill.)

Pharmacol. 210. History of Pharmacology. (2)

(Burgison.)

Pharmacol. 399. Research.

Maximum credits, 12. Credit in accordance with the amount of work accomplished. (Bryant, Burgison, Cascorbi, O'Neill, Rozman, Truitt, Rudo.)

PHYSIOLOGY

Professors: BLAKE AND BARRACLOUGH.

Associate Professors: ADELMAN, COLEMAN, GLASER, MERLIS, AND PINTER.

Assistant Professors: FAJER, GREISMAN, AND KARPELES.

There are three graduate programs available to students interested in physiology: (1) a predoctoral program leading to the Ph.D. degree; (2) a predoctoral program leading to the Ph.D. degree with specialization in gerontology; and (3) a seven year predoctoral program leading to both M.D. and Ph.D. degrees. Prerequisites include differential and integral calculus, general physics, physical chemistry and comparative anatomy, although one of these may be taken concurrent with the first year of the predoctoral Ph.D. program. All programs include course work in anatomy, biochemistry and/or biophysics, instrumentation, statistics, and computers. Fellowships and assistantships are available for qualified applicants.

For Graduates and Advanced Undergraduates

PHYSIOL. 101. PRINCIPLES OF PHYSIOLOGY. (8)

Second semester. Four lectures, two laboratories, and two conferences per week for 16 weeks. Lectures cover major areas of organ-system physiology except for the nervous system which is embodied in Neuroanatomy 101. Laboratory work is classical exercises for 8 weeks and a "project" experiment for 8 weeks. Conferences are on laboratory work. Laboratory fee, $15.00. (Staff.)

For Graduates

PHYSIOL. 201. PRINCIPLES OF PHYSIOLOGY. (9)

Same as Physiol. 101, for graduate students majoring in physiology. Additional reading and attendance at departmental seminars are required. Laboratory fee $15.00. (Staff.)

PHYSIOL. 202. CARDIOVASCULAR PHYSIOLOGY. (2)

Reading assignments, seminars, conferences, two hours a week for 15 weeks, on current research in cardiovascular physiology. (Karpeles.)

PHYSIOL. 203. PULMONARY PHYSIOLOGY. (2)

Two hours a week for 15 weeks. Reading assignments, lectures, seminars on current research in pulmonary physiology. (Staff.)

PHYSIOL. 204. PHYSIOLOGICAL TECHNIQUES.

Time and credit by arrangement. The various technical procedures currently operating in the Department will be demonstrated and opportunity will be given for acquiring experience with them. (Staff.)

PHYSIOL. 205. PHYSIOLOGY OF KIDNEY AND BODY FLUIDS. (2)

Two hours a week, lectures, seminars and conferences, for 15 weeks. Consideration will be given to the current status of knowledge of renal function and body fluids in vertebrates, with particular reference to mammals. (Blake, Pinter.)

Physiol. 206. Seminar.

Credit according to work done. Weekly meetings are held to discuss recent literature and results of departmental research. (Staff.)

Physiol. 207. Physiology of the Central Nervous System. (2)

Two hours a week for 15 weeks. Lectures, seminars and reading assignments on current knowledge of central nervous system function. (Coleman, Merlis.)

Physiol. 208. Physiology of the Autonomic Nervous System. (2)

Two hours a week for 15 weeks. Lectures, seminars and reading assignments on current knowledge of autonomic nervous system function. (Blake.)

Physiol. 209. General Physiology. (2)

Two hours a week for 15 weeks. Lectures, reading assignments, and seminars on selected topics in general, cellular and neurophysiology. (Adelman.)

Physiol. 210. Physiological Systems. (3)

Three or four hours a week for 15 weeks. Lectures, conferences, and laboratory sessions on the theoretical principles of biological control systems. (Glaser.)

Physiol. 211. Sensory Physiology. (3)

Two hours lecture and conference, one laboratory period a week for 15 weeks on sensory systems. (Coleman, Merlis.)

Physiol. 212. Physiology of Reproduction. (2)

Lectures, two hours a week for 15 weeks. A comprehensive survey of reproductive endocrinology. (Barraclough.)

Physiol. 213. Seminar in Neuroendocrinology. (2)

Two hours a week for 15 weeks. Lectures and seminars on recent advances in nervous regulation of endocrine function. (Barraclough.)

Physiol. 214. Comparative Adrenal Physiology. (2)

Lectures and conferences, two hours a week for 15 weeks, on current knowledge of vertebrate adrenal function. (Fajer.)

Physiol. 399. Research.

By arrangement with Head of the Department. (Staff.)

SCHOOL OF NURSING

NURSING ADMINISTRATION

GENERAL PSYCHIATRIC NURSING

NURSING OF CHILDREN WITH PSYCHIATRIC DISORDERS

MATERNAL AND CHILD NURSING

MEDICAL-SURGICAL NURSING

PUBLIC HEALTH NURSING

Professors: Gipe, Carl and Grenell.

MAJOR OBJECTIVES OF THE GRADUATE PROGRAM

The Graduate Program in Nursing leading to the degree of Master of Science is designed primarily to prepare registered nurses in administration in nursing education and nursing services. This program includes a graduate clinical core of maternal and child health, medical and surgical nursing, psychiatric nursing, or public health nursing. Graduates of these programs are prepared as administrators, consultants, supervisors and teachers.

ADMISSION REQUIREMENTS

Admission to the graduate program in nursing requires the applicant to be a registered nurse who has completed an undergraduate degree with academic standing which is recognized by the Graduate School of the University of Maryland. The applicant must have completed basic college or university courses in physical and natural sciences (i.e., chemistry, microbiology, anatomy and physiology); and in the behavioral sciences (i.e., psychology, sociology, anthropology). In addition, the applicant must have clinical experience in medical and surgical nursing, psychiatric nursing, maternal and child nursing, and public health nursing which is comparable to the requirements in the basic undergraduate program in nursing at the University of Maryland.

CURRICULUM REQUIREMENTS

Requirements for the Master of Science Degree in Administration in Nursing include the satisfactory completion of a minimum of forty semester hours of graduate work. The forty semester hours of study and field experience extend through three college semesters and include clinical nursing and directed field experience either in University of Maryland Hospital or an associated hospital in Baltimore. The forty semester hour program includes thirty-four semester hours of course work and six semester hours for the thesis. Twenty-two semester hours must be taken

in the major field, and a minimum of twelve semester hours in the minor field. It is required that at least twenty-two semester hours of course work be taken in courses numbered in the catalogue as 200 or above.

Requirements for the Master of Science Degree in General Psychiatric Nursing include the satisfactory completion of a minimum of thirty-eight semester hours of graduate work. The program extends through three college semesters, and includes clinical study and supervised experience in intensive nurse-patient interaction, and nursing care of groups of mentally ill patients through nurse intervention and the use of the therapeutic community. The student is provided supervised learning experience in teaching of psychiatric nursing or supervising psychiatric nursing services. The program includes thirty-two hours of course work and six semester hours of thesis. Eight semester hours are required in the minor field. It is required that at least twenty semester hours of course work be taken in courses numbered in the catalogue as 200 or above.

Requirements for the Master of Science Degree in Nursing of Children with Psychiatric Disorders include the satisfactory completion of a minimum of fifty-three semester hours of graduate work. The program extends through four college semesters, and includes clinical study and supervised experience in establishing and maintaining intensive nurse-child relationships; working as a member of a psychiatric inter-disciplinary team; establishing, maintaining, and providing a continuity of therapeutic relationships in the home setting with families of the children who are receiving intensive treatment; and guided observation and participation with individual, and groups of, disturbed pre-school children who attend the Children's Guild, Inc. The student is provided supervised learning experiences in administering, teaching, supervising, and consulting with reference to nursing of children with psychiatric disorders.

Requirements for the Master of Science Degree in Medical and Surgical Nursing include the satisfactory completion of at least thirty semester hours of graduate work. The thirty hour program includes twenty-four semester hours of course work and six semester hours for the thesis. At least twelve semester hours must be taken in the major field, and at least eight semester hours must be taken in the minor field. It is required that at least tweleve semester hours of course work be taken in courses numbered in the catalogue as 200 or above.

Requirements for the Master of Science Degree in Maternal and Child Nursing include the satisfactory completion of at least thirty semester hours of graduate work. The thirty hour program includes twenty-four semester hours of course work and six semester hours for the thesis. At least twelve semester hours must be taken in the major field, and at least eight semester hours must be taken in the minor field. It is required that at least twelve semester hours of course work be taken in courses numbered in the catalogue as 200 or above.

Requirements for the Master of Science Degree in Public Health Nursing include the satisfactory completion of a minimum of thirty-seven semester hours of graduate work. The program extends through three college semesters, and includes clinical study and supervised experience in public health nursing. The student is provided supervised learning experience in teaching public health nursing or supervising public health nursing. The program includes thirty-one hours of course work and six semester hours of thesis. Eight semester hours are required in the minor field. It is required that at least twenty semester hours of course work be taken in courses numbered in the catalogue as 200 or above.

THESIS

A thesis representing research in the major field must be approved by the advisor of the student and presented to the Dean of the Graduate School as partial requirement for the Master of Science Degree. Final approval of the thesis is given by the examination committee appointed by the Dean of the Graduate School.

LEARNING EXPERIENCES

Through graduate study the student broadens and deepens understandings built first upon knowledge and then greater understanding of a particular specialty of study and work. Having the privilege of studying with graduate students in other disciplines, the graduate student in nursing has opportunities to transfer knowledge from other areas to enrich her understandings in her particular field of specialty. The graduate student is given opportunity to learn to pursue, evaluate and apply results of research in nursing in order to find better ways of improving patient care.

The extensive clinical facilities of the University of Maryland and associated institutions provide an excellent climate where this dynamic learning can occur. Seminars, workshops, institutes and conferences also provide opportunities for extending the scope of understanding of the graduate student. Depending upon the functional interest, the student receives practice in administration, teaching, supervision, and consultation under guidance.

For Graduates

NURS. 201. TRENDS OF HIGHER EDUCATION IN NURSING. (2)

First semester. The central objective of this course is to bring to the student in nursing education a knowledge and an understanding of the current status of nursing in institutions of higher learning and what nursing must have as a goal before it can become a universally accepted profession.

(Kelsey, Cohelan.)

NURS. 202. INTERPERSONAL INTERACTION. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is primarily concerned with the application of psychodynamics and psychoanalytic understandings to the nurses' relationships with patients.
(Carl, Cohelan, Eischler.)

NURS. 203. NURSING IN SOMATIC THERAPIES. (2)

First semester. One lecture and one two-hour laboratory period a week. This course is planned to provide (1) increased knowledge and understanding of neuro-physiological aspects of behavior of the psychiatric patient and (2) increased ability in application of mental health concepts to the nursing care of patients in all clinical areas. (Cohelan, Miller.)

NURS. 204, 205. PSYCHIATRIC NURSING. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course includes dynamics of human behavior, including formation of personality, the techniques of problem solving and the skills of communication in relation to therapeutic nursing care of psychiatric patients.
(Carl, Cohelan.)

NURS. 206. PHILOSOPHICAL CONCEPTS IN HEALTH. (Epidemiology). (2)

Second semester. Two-hour lecture a week. The course is planned with a contemporary approach to the problem of philosophical concepts in health. The discussions begin with general considerations and progress to the application of these concepts to more specific situations. (Staff.)

NURS. 207, 208. NURSING IN CHILD HEALTH SERVICES. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. This course is concerned with extensive knowledge and understanding of the place of nursing in the society's total program of child health services and increased skill in the nursing of children. (Reed.)

NURS. 209, 210. NURSING IN MATERNAL AND NEWBORN SERVICES. (2, 2)

First and second semester, one lecture and two four-hour laboratory periods a week. This course is concerned with extensive knowledge and understanding of maternal care and the opportunity to make application in varying nursing situations which relate to the patient, to the family and to the community.
(Hydorn.)

NURS. 211. SEMINAR IN MATERNAL AND CHILD HEALTH SERVICES. (2)

Second semester. One two-hour period a week. This course is concerned with understanding and purposeful application of maternal and child health nursing as it normally exists within the family. The influence of the nurse on maternal and child health is traced through the many institutions and agencies where she contacts the mother and child, or the family as a whole.
(Borlick, Hydorn, Reed.)

NURS. 212, 213. MEDICAL AND SURGICAL NURSING. (2, 2)

First and second semester. One lecture and two four-hour laboratory periods a week. Nurs. 212 is available during the fall semester and is prerequisite to Nurs. 213 which is available during the spring semester. The selected course

activities are arranged by each student and a teacher to comprise a program of study which will best prepare the student for the purposive improvement of medical and surgical nursing practice. (Hosfeld, De Haven.)

NURS. 214. APPLICATION OF PRINCIPLES OF PHYSICAL AND SOCIAL SCIENCES IN NURSING. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is designed to apply physical and social science principles in life situations in such a way that similar situations will be recognized by the learners in their day to day application. (Smith, Staff.)

NURS. 215. NURSING CARE OF THE EMOTIONALLY DISTURBED PRE-SCHOOL CHILD. (2)

Second semester. One lecture and two four-hour laboratory periods a week. Requisite-Concurrent enrollment in Nurs. 208—Nursing in Child Health Services (2). This course is designed to extend the knowledge and understanding of the graduate nurse at the Master's level in the principles of management and guidance of the emotionally disturbed pre-school child. Learning experiences will include guided observations, staff consultations and seminars to acquaint nurses with the professional activities of a Therapeutic Pre-School Center. (Reed, Kanner, Clarke.)

NURS. 220, 221. PUBLIC HEALTH NURSING. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. This course is designed to extend knowledge, understanding, and competencies of the nurse at the Master's level in comprehensive public health nursing, including total planning to meet the health needs of individuals and families in the community. Learning experiences will include selected clinical observations and participation in public health nursing, selected activities such as community health conferences, and interdisciplinary health consultations in a variety of community health settings. (Borlick.)

NURS. 222. PUBLIC HEALTH ADMINISTRATION. (2)

First semester. Two-hour lecture a week. This course is designed to extend knowledge and understanding of the nurse at the Master's level of the principles of organization and administration of public health services, including budgeting, program planning, coordination, interpersonal relationships, and medical care practices, so as to increase the competencies of practice in teaching or supervising public health nursing. (Beard, Borlick.)

NURS. 250. COMPREHENSIVE NURSING OF CHILDREN WITH PSYCHIATRIC DISORDERS. (4)

First semester. Two two-hour lectures and four four-hour laboratory periods a week. Prerequisite, Nurs. 202—Interpersonal Interaction (2), and Nurs. 204-205—Psychiatric Nursing (2, 2).

This course includes planning and implementation of nursing care of children who are mentally ill and who are receiving intensive care in a residential treatment center. Learning experiences include seminars in psychodynamic theory of mental illness of children, intensive nursing-child relationships, working as a member of a psychiatric interdisciplinary team, establishing, maintaining, and providing continuity of therapeutic relationships in the home setting with families of the children who are receiving intensive treatment. (Charlton, Rafferty.)

NURS. 251. NURSING OF PRE-SCHOOL CHILDREN WITH DEVIATE BEHAVIOR. (4)

Second semester. Two two-hour lectures and four four-hour laboratory periods a week. Prerequisite, Nurs. 250—Comprehensive Nursing of Children with Psychiatric Disorders (4). This course includes guided observation and participation with individual and groups of disturbed pre-school children who attend the Children's Guild, Inc. Learning experiences include participation in psychological consultations and staff conferences, analysis and evaluation of problems of individual children and group therapy. Each student receives individual guidance throughout the course. (Charlton, Kanner, Kraft.)

NURS. 252. NURSING OF CHILDREN WITH NORMAL BEHAVIOR. (2)

Second semester. One lecture and one two-hour laboratory period a week. This course provides a basis of comparison of the behavior of pre-school children with deviate and normal behavior. Learning experiences will be provided at the Children's Guild, Inc. and will include guide observation of normal childhood play and learning in the nursery, kindergarten, and day care centers. Laboratory study of normal physical and motor development, social relationships, language skills, the meaning of play, and use of intellectual and creative media. (Charlton, Kanner, Clarke.)

NURS. 285. CURRICULUM DEVELOPMENT IN NURSING. (2)

First semester. One two-hour lecture a week. Prerequisite; Psych. 110—Educational Psychology (3) or its equivalent. This course is designed to assist the student in curriculum planning, improvement, and evaluation including the formulation of objectives and the selection and organization of content and learning activities in nursing education. (Hovet, Marriott.)

NURS. 286. RESEARCH METHODS AND MATERIALS IN NURSING. (2)

First semester. One two-hour lecture or conference period a week. The course deals with basic understandings of philosophical aspects as they relate to research, including the nature of scientific thinking, methods of research, and research literature in nursing. (Gipe, Carl.)

NURS. 287. SEMINAR IN NURSING—TEACHING OR SUPERVISION. (2)

Second semester. The purpose of this course is to develop the necessary knowledge, understanding, and skill in instruction or supervision in nursing. (Staff.)

NURS. 288S. SPECIAL PROBLEMS IN NURSING. (1-6)

Prerequisites, Nurs. 204-205; or Nurs. 207-208; or Nurs. 209-210. The major objective of this course is to develop further clinical and research competencies in selected students who have completed a graduate core of clinical nursing. Registration upon consent of adviser. (Staff.)

NURS. 290. ADMINISTRATION IN NURSING. (3, 3)

The purpose of this course is to provide opportunities for professional nurses, with experience in teaching in schools of nursing and/or nursing services, to gain further competence, through planned study and experience, in the area of nursing administration. If previous preparation in teaching or supervision in some clinical area is inadequate, student will be obliged to select graduate courses in the area of Psychiatric Nursing, Maternal and Child Health Nursing, or Medical and Surgical Nursing. (Gipe, Staff.)

NURS. 399. RESEARCH THESIS. (1-6)

(Staff.)

SCHOOL OF PHARMACY

PHARMACY

Professor: FOSS.

Associate Professors: ALLEN AND SHANGRAW.

Assistant Professor: LAMY.

The Department of Pharmacy offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. The student may specialize in the areas of industrial pharmacy, biopharmaceutics and hospital pharmacy. Graduate students working in this department must have a degree in pharmacy, and may be required to take some additional undergraduate courses to fulfill specified requirements. Information regarding specific requirements for the degree may be obtained from the Department.

For Graduates and Advanced Undergraduates

PHARMACY 153, 154. ADVANCED DISPENSING PHARMACY. (3, 3)

Two lectures and one laboratory. Prerequisite, Pharmacy 44. Professional laboratory practice and other specialized activities pertaining to prescriptions, including an evaluation of compounding aids and commercial pharmaceuticals. (Allen.)

PHARMACY 156. COSMETICS AND DERMATOLOGICAL PREPARATIONS. (3)

Second semester. Two lectures and one laboratory. Prerequisite, Pharmacy 153. A study of the composition and manufacture of cosmetic and dermatological preparations including laboratory work in the formulation of these products. (Allen.)

PHARMACY 157. HOSPITAL PHARMACY ADMINISTRATION I.

First semester. Two lectures. Prerequisite, Pharmacy 44. The fundamentals of hospital pharmacy practice and administration. Includes a study of the history and development of hospital pharmacy, physical facilities, minimum standards, purchasing, the formulary, record keeping, and dispensing practices. (Lamy.)

PHARMACY 158. HOSPITAL PHARMACY ADMINISTRATION II.

Second semester. Two lectures. Prerequisite, Pharmacy 157. An orientation to the function of the hospital pharmacy within the hospital. A study of the administrative organization of a hospital and the interrelationship of the various hospital departments with the hospital pharmacy. (Lamy.)

For Graduates

PHARMACY 201, 202. INDUSTRIAL PHARMACY. (3, 3)

Given in alternate years. Two lectures. Prerequisites, Pharmacy 153, 154. A study of manufacturing processes, control procedure and equipment employed in the manufacture of pharmaceuticals on a commercial scale, including new drug applications and the Federal Food, Drug and Cosmetic Act. (Shangraw.)

Pharmacy 203, 204. Industrial Pharmacy. (2, 2)
Two laboratories. Prerequisites, Pharmacy 201, 202, or may be taken simultaneously with Pharmacy 201, 202. Laboratory work dealing with the preparation of useful and important pharmaceuticals in large quantities. (Shangraw.)

Pharmacy 207, 208. Physical Pharmacy. (2, 2)
Two lectures a week. Prerequisite, consent of the instructor; Physical Chemistry 187, 188, 189, 190 recommended. A study of pharmaceutical systems utilizing the fundamentals of physical chemistry. (Shangraw.)

Pharmacy 211, 212. Survey of Pharmaceutical Literature. (1, 1)
One lecture. Lectures and topics on the literature pertaining to pharmacy, with special reference to the origin and development of the works of drug standards and the pharmaceutical periodicals. (Allen.)

Pharmacy 215, 216. Product Development. (2, 2)
Two laboratories. Prerequisites, Pharmacy 201, 202, 207, 208 or permission of instructor. A laboratory course in which the student is required to formulate a medicinal agent into a dosage form and provide all information, including stability data, control procedures, analytical tests, manufacturing and labeling specifications, trade mark and patent application necessary to meet present FDA requirements. (Shangraw.)

Pharmacy 221, 222. History of Pharmacy. (2, 2)
Given in alternate years. Two lectures. Lectures and assignments on the development of pharmacy in America and the principal countries of Europe. (Staff.)

Pharmacy 230. Pharmaceutical Seminar. (1)
Each semester. Required of students majoring in pharmacy. Reports of progress in research and surveys of recent developments in pharmacy. (Lamy.)

Pharmacy 231, 232. Special Problems in Pharmaceutical Technology. (2, 2)
Two laboratories. A study of technical problems in the stabilization and preservation of pharmaceuticals and the various methods of compounding special prescriptions. (Allen.)

Pharmacy 399. Research in Pharmacy.
Credit and hours to be arranged. (Foss, Allen, Shangraw, Lamy.)

PHARMACEUTICAL CHEMISTRY

Professor: Miller.

Associate Professor: Zenker.

Assistant Professor: Abushanab and Leslie.

The Department of Pharmaceutical Chemistry offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. The student may specialize in the areas of synthetic medicinal chemistry, natural product chemistry, biochemistry or biophysical chemistry. For

graduate study in pharmaceutical chemistry, the student must have a degree in either pharmacy or chemistry. Information regarding specific requirements for the degree may be obtained from the Department.

For Graduates and Advanced Undergraduates

CHEM. 141, 143. ADVANCED ORGANIC CHEMISTRY. (2, 2)

Two lectures. Prerequisites, Chemistry 35, 36, 37, 38. An advanced study of the compounds of carbon. (Miller.)

PHARM. CHEM. 149. PRINCIPLES OF BIOCHEMISTRY. (5)

Four lectures and one laboratory. Prerequisites, Pharmaceutical Chemistry 32, 34. Lectures and laboratory exercises devoted to the composition of living organisms and the chemical and physical processes which occur during health and in disease. (Zenker.)

PHARM. CHEM. 151, 152. CHEMISTRY OF MEDICINAL PRODUCTS. (3, 3)

Three lectures. Prerequisite, Pharmaceutical Chemistry 30, 32, 34. A survey of the structural relationships, synthesis and chemical properties, principally of organic medicinal products. (Abushanab.)

CHEM. 187, 189. PHYSICAL CHEMISTRY. (3, 3)

Three lectures. Prerequisites, Chemistry 19, 35, 37, Physics 20, 21 and Mathematics 20, 21. A study of laws and theories of chemistry, including the gas laws, kinetic theory, liquids, solutions, elementary thermodynamics, thermochemistry, equilibrium, chemical kinetics and electro-chemistry. (Leslie.)

CHEM. 188, 190. PHYSICAL CHEMISTRY. (2, 2)

Two laboratories. Prerequisites, Chemistry 187, 189 or may be taken simultaneously with Chemistry 187, 189. Quantitative experiments are performed which demonstrate physio-chemical principles, and acquaint the student with precision apparatus. (Leslie.)

For Graduates

PHARM. CHEM. 210, 211. TECHNIQUES OF CHEMICAL RESEARCH. (3, 3)

One lecture, two laboratories. Prerequisites, Chemistry 141, 143, 187-190 or concurrent registration. Lectures and laboratory exercises devoted to the systematic separation, characterization and identification of organic structures by chemical and instrumental methods, to the synthesis of organic structures of the more difficult types including isotopically labeled compounds and to isotope counting techniques. (Staff.)

PHARM. CHEM. 230. SEMINAR. (1).

Each semester. Required of students majoring in pharmaceutical chemistry. Reports of progress and survey of recent developments in chemistry. (Staff.)

PHARM. CHEM. 235. PRINCIPLES OF STEREOCHEMISTRY. (2)

Two lectures. Prerequisite, Chemistry 141, 143. A study of the principles of stereo-chemistry of organic compounds. (Miller.)

PHARM. CHEM. 242. HETEROCYCLIC CHEMISTRY. (2)

Two lectures. Prerequisite, Chemistry 141, 143. A study of the chemistry and synthesis of heterocyclic compounds. (Staff.)

PHARM. CHEM. 250. STEROIDS. (2)

Two lectures. Prerequisite, Chemistry 141, 143. A study of the synthesis and structure determination of steroids and the application of modern chemical concepts to the chemistry of steroids. (Staff.)

PHARM. CHEM. 252. ALKALOIDS. (2)

Two lectures. Prerequisite, Chemistry 141, 143. A study of the principles involved in structure determination, chemistry and synthesis of the major alkaloidal classes. (Miller.)

PHARM. CHEM. 253, 254. ADVANCED CHEMISTRY OF MEDICINAL PRODUCTS. (2, 2)

Two lectures. Prerequisite, Pharmaceutical Chemistry 151, 152 and Chemistry 141, 143 or permission of the instructor. A study of structural relationships and basic principles concerned with the physical and chemical mechanisms of drug action, e.g., structure-activity relationships, physical properties and biological activity, cellular transport, drug, protein binding, biological receptors, lipid storage and physico-chemical mechanisms of drug action. (Staff.)

PHARM. CHEM. 271. BIOPHYSICAL CHEMISTRY. (2)

Two lectures. Prerequisite, Pharmaceutical Chemistry 149, Chemistry 189. The application of physical chemical principles to biological systems, and a discussion of the physical properties of biologically important macromolecules. (Leslie.)

PHARM. CHEM. 272. SELECTED TOPICS IN PHYSICAL CHEMISTRY. (2)

Two lectures. Prerequisites, Chemistry 189. A discussion of selected topics of particular interest in the pharmaceutical sciences, including surface chemistry, colloids, kinetics, colligative properties and absorption spectroscopy. (Leslie.)

PHARM. CHEM. 274. ADVANCED PHYSICAL CHEMISTRY LABORATORY. (1)

One laboratory. Prerequisite, Chemistry 190. Selected experiments which are necessary for, and a part of, a larger research effort. (Leslie.)

PHARM. CHEM. 281. METABOLIC INHIBITORS. (2)

Two lectures. Prerequisite, Pharmaceutical Chemistry 149. A discussion of the design, the mode of action of the enzymatic level, and the metabolism of biochemical analogs. (Zenker.)

PHARM. CHEM. 282. ADVANCED BIOCHEMISTRY LABORATORY. (2)

Two laboratories. Prerequisites, Pharmaceutical Chemistry 281 or permission of the instructor. Laboratory experiments designed to illustrate the use of modern techniques and metabolic methods in the study of drug action and drug metabolism. (Zenker.)

PHARM. CHEM. 399. RESEARCH IN PHARMACEUTICAL CHEMISTRY.

Credit determined by the amount and quality of work performed. (Staff.)

PHARMACOLOGY

Professor: ICHNIOWSKI.

Assistant Professor: DRIEVER.

The Department of Pharmacology offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. The Department emphasizes the areas of quantitative pharmacology, pharmacodynamics and will extend into biochemical pharmacology (distribution, metabolism and excretion of drugs). Students with a degree in pharmacy are preferred; however, students with a strong background in both chemistry and biology are also considered for graduate study in pharmacology. Information regarding specific requirements for the degree may be obtained from the Department.

For Graduates and Advanced Undergraduates

PHARMACOLOGY 155, 156. GENERAL PHARMACOLOGY. (4, 5)

Three lectures, one laboratory first semester; four lectures, one laboratory second semester. Prerequisites, Physiology 142, Pharmaceutical Chemistry 149 or consent of the instructor. A study of the pharmacology, toxicology, posology, untoward effects, precautions and therapeutic applications of medicinal substances. (Ichinowski and Driever.)

PHARMACOLOGY 171. OFFICIAL METHEDS OF BIOLOGICAL ASSAY. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Pharmacology 155, 156. A study of the official methods of biological assay of the United States Pharmacopoeia and the National Formulary. (Ichniowski.)

For Graduates

PHARMACOLOGY 201, 202. METHODS OF BIOLOGICAL ASSAY. (4, 4)

First and second semesters. Laboratory and conferences. Prerequisite, Pharmacology 171. A study of the more important unofficial methods used in the quantitative evaluation of therapeutic substances. (Ichniowski.)

PHARMACOLOGY 211, 212. SPECIAL STUDIES IN PHARMACODYNAMICS. (4, 4)

First and second semesters. Laboratory and conferences. Prerequisites, Pharmacology 155, 156 and the approval of the instructor. Offered in alternate years. A study of the methods used in the evaluation of drug action. (Ichniowski.)

PHARMACOLOGY 221, 222. SPECIAL STUDIES IN BIOLOGICAL ASSAY METHODS. (2-4, 2-4)

Credit according to the amount of work undertaken after consultation with the instructor. First and second semester. Laboratory and conferences. Prerequisite, Pharmacology 171, 201, 202. Special problems in the development of biological assay methods. (Ichniowski.)

PHARMACOLOGY 399. RESEARCH IN PHARMACOLOGY

Properly qualified students may arrange with the instructor for credit and hours. (Ichniowski.)

PHARMACOGNOSY

Professor: Slama

Assistant Professor: Euler

The Department of Pharmacognosy offers a graduate program leading to the Master of Science degree. The student may specialize in the areas of phytochemistry, plant chemotaxonomy and plant culture. Graduate students in pharmacognosy must have a Bachelor of Science degree in Pharmacy. Information regarding specific requirements for the degree may be obtained from the Department.

For Graduates and Advanced Undergraduates

Pharmacognosy 101, 102. Taxonomy of the Higher Plants. (2, 2)

Given in alternate years. One lecture and one laboratory. Prerequisite, Pharmacognosy 41, 42. A study of the kinds of seed plants and ferns, their classification, and field work on local flora. Instruction will be given in the preparation of an herbarium. (Slama.)

Pharmacognosy 111, 113. Plant Anatomy. (2, 2)

Two lectures a week. Prerequisites, Pharmacognosy 41, 42. (Slama.)

Pharmacognosy 112, 114. Plant Anatomy. (2, 2)

Two laboratory periods a week. Prerequisites, Pharmacognosy 41, 42; Pharmacognosy 111, 113. Laboratory work covering advanced plant anatomy with special emphasis placed on the structure of roots, stems, and leaves of vascular plants. (Slama.)

For Graduates

Pharmacognosy 201, 202. Advanced Study of Vegetable Powders. (4, 4)

Given in alternate years. Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 113. A study of powdered vegetable drugs and spices from the structural and microchemical standpoints, including practice in identification and detection of adulterants. (Slama.)

Pharmacognosy 211, 212. Advanced Pharmacognosy. (4, 4)

Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 113. A study of many crude drugs not ordinarily studied in other pharmacognosy courses. Special attention will be given to practical problems and to the identification and detection of adulterants. (Euler.)

Pharmacognosy 399. Research in Pharmacognosy.

Credit according to the amount and quality of work performed. (Slama.)

MICROBIOLOGY

Professor: SHAY

Assistant Professor: KRYWOLAP

The Department of Microbiology serves both the School of Pharmacy and the School of Dentistry and offers programs leading to the degrees of Master of Science and Doctor of Philosophy. The student may specialize in the areas of pathogenic microbiology, fermentation microbiology, antibiotics, antiseptics, oral protozoa, immunology, mycology and transmission of infectious agents. For graduate study in microbiology, the student should have a degree in microbiology or pharmacy. Information regarding specific requirements for the degree may be obtained from the Department.

For Graduates and Advanced Undergraduates

MICROB. 146. SEROLOGY, IMMUNOLOGY, PUBLIC HEALTH AND PARASITOLOGY. (4)

Prerequisite, Microbiology 41 or its equivalent. Two lectures and two laboratories. A study of the principles of immunity, including the preparation and use of biological products employed in the prevention and treatment of infectious diseases. Attention is given to hypersensitivity of humans and animals. Part of the course is devoted to the study of public health. Time is given to the study of medical parasitology, pathology and parasitic infections. (Shay.)

For Graduates

MICROB. 200, 201. CHEMOTHERAPY. (1, 1)

Alternate years. Prerequisites, Microbiology 121 or equivalent, Biochemistry 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs in the treatment of disease. (Shay.)

MICROB. 202, 203. REAGENTS AND MEDIA. (1, 1)

Offered in alternate years. Consideration of media for special procedures such as antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements of specific groups of micro-organisms. (Shay.)

MICROB. 210. SPECIAL PROBLEMS IN MICROBIOLOGY.

Laboratory course. Special studies in the various divisions of microbiology. Credit determined by amount and quality of work performed. (Shay.)

MICROB. 211. PUBLIC HEALTH. (2)

Prerequisite, Microbiology 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The applications of statistical and epidemiological methods to health problems is illustrated through lectures and demonstration. (Shay.)

MICROB. 212. BACTERIAL FERMENTATIONS. (2)

Two lectures. (Given second semester in alternate years). Prerequisite, Biochemistry 111 or an equivalent course and Microbiology 121 or an equivalent course. This course covers composition, nutrition and growth of microorganisms; influence of physical and chemical environment on metabolism; chemical activities of microorganisms; mechanisms of fermentative and oxidative metabolism. (Krywolap.)

MICROB. 221. RESEARCH IN MICROBIOLOGY.

Credit determined by amount and quality of work performed. Open only to candidates for advanced degrees in microbiology. (Shay.)

MICROB. 281-283. SEMINAR. (1, 1)

Presentation and discussion of current literature and research in the field of microbiology. (Shay.)

MICROB. 399. THESIS RESEARCH

(Shay.)

PHYSIOLOGY

Professor: COSTELLO

The Department of Physiology offers a graduate program leading to the Master of Science degree and in cooperation with the School of Medicine and School of Dentistry, a program leading to the Doctor of Philosophy degree. The student may specialize in cellular physiology with special emphasis on endocrine, environmental and developmental aspects. Prerequisite for study in physiology include a degree in pharmacy or a background in the biological sciences from a college of arts and sciences or a professional school. Information regarding specific requirements for the degree may be obtained from the Department.

PHYSIOL. 245. CELLULAR PHYSIOLOGY AND CYTOGENETICS. (3)

First semester, three lectures. Prerequisites, Pharmaceutical Chemistry 149, Physiology 142, consent of instructor. The lectures will relate to the physical and chemical properties of protoplasm to the functional problems of the plasma membrane, cytoplasm, golgi apparatus, microsomes, nucleus, mitochondrial structure and their contributions to the integrated cellular activity. The physical and chemical phenomena of cell division and inheritance will be discussed. (Costello.)

PHYSIOL. 246. RADIOISOTOPE TECHNIQUES. (3)

Second semester, one lecture and two laboratories. Prerequisites, consent of instructor. A course concerned with the practical use of isotopes particularly as tracers in metabolic investigations. (Costello.)

PHYSIOL. 399. RESEARCH IN PHYSIOLOGY.

Credit determined by the amount and quality of work performed. (Costello.)

MATHEMATICS

For Graduates and Advanced Undergraduates

Math. 130. Probability. (3)

First semester. Prerequisite, Math. 21 or equivalent. Combinatory analysis, total, compound, and inverse probability, continuous distributions, theorems of Bernoulli and Laplace, theory of errors. (Staff.)

Math. 132. Mathematical Statistics. (3)

Second semester. Prerequsite. Math. 21 or equivalent. Frequency distributions and their parameters, multivariate analysis and correlation, theory of sampling, analysis of variance, statistical inference. (Staff.)

SCHOOL OF SOCIAL WORK

Professors: Lewis, Lansdale.

Associate Professors: Chaiklin, Thursz.

Assistant Professors: Arens, Borom, Boucher, Blumberg, Germain, Jennings, Kahn, Keith, Levi, McCall, McCune, Moses, Taylor, Young.

Lecturers: Cumming, Howard, Lichtenberg, Lisansky, Maxwell, Reidy, Ryan.

For Graduates

THE SOCIAL SERVICES

SW 200, 201. Social Services and Social Policy. (2, 2)

Both semesters. Identification of social needs and analysis of social services with particular reference to political, social, and economic forces affecting their development. The social control and melioration functions of social welfare programs. Examination of the growth, organization and function of governmental and voluntary services. Open to qualified part-time students with consent of instructor. (Arens, Lansdale.)

SW 202. The Social Work Profession. (2)

Second year. The historical background and development of the profession. Current trends in professional practice. Professional concerns with social policy. Professional values and ethncal behavior. (Cumming, Thursz, Young.)

SW 203. Community Social Welfare Services. (2)

First semester, concurrent with SW 200. Participant observation of community provision for control of selected social problems: dependency, disordered behavior, indigent disability. Consideration of social work roles in alleviation and control of selected problems. Open to qualified part-time students enrolled in SW 200. (Arens, Stoll.)

SW 205. Social Welfare History. (2)

The changing concept of charity from Biblical to modern times. Origin of English and American poor laws. Charity organization and the growth of voluntary efforts. Origins and development of welfare state concept. Open to qualified part-time students with consent of instructor. (Lewis.)

GROWTH AND BEHAVIOR

SW 210. Human Behavior I. (2)

First semester. Concepts basic to understanding adult social functioning with particular reference to characteristic ways of responding to stressful situations arising out of economic disadvantage, sociocultural conflict, illness and disability. Attention to the family as a social system and the social roles of family members in the patterning of relationships. (Jennings, Young.)

SW 211. Human Behavior II. (2)

Elaboration of concepts introduced in SW 210. Introduction of psychodynamic concepts used in assessment of psychosocial disorders. (Jennings, Young.)

SW 212. Human Behavior III. (2)

Descriptive and dynamic considerations in psychosocial disorders and psychopathology likely to be encountered in social work practice, i.e., indigency, marital disorder. delinquent and criminal behavior. personality disorders. retardations. illegitimate parenthood. child neglect and placement, neuroses, and phychoses. (Lichtenberg.)

SW 213. Human Behavior IV. (2)

Second semester, second year. Concepts basic to an understanding of personality development in childhood and adolescence. Application of psychodynamic formulations in differential diagnosis and planning use of casework and groupwork techniques appropriate to the client's needs. Analysis of social work, sociological and biographical case materials utilizing psychosocial concepts. (Reidy,)

SW 214. Nature and Ecology of Health and Illness. (1)

Introduction to causes, symptoms, treatment, distribution, prevention and control of disease. Social and psychological aspects of illness, emphasizing factors influencing response to stress. Socio-economic problems of health care. Coordination of health and social resources as relevant to social work practice. (Lisansky.)

SW 215. Behavior of Human Groups. (2)

Examination of concepts underlying social work practice as drawn from theory of social systems. Special reference to families, small groups, neighborhoods, communities, to social institutions and to culture. Reference also to leadership theory and related formulations useful in understanding interpersonal relationships in families, committees, clubs, social agencies and special interest groups. Open to qualified part-time students with consent of instructor. (Chaiklin, Staff.)

SOCIAL WORK PRACTICE

SW 220, 221. Social Casework. (2, 2)

Both semesters, first year. Fundamental concepts and principles of the casework method. Emphasis on understanding the person presenting the social problem, the environment, especially the family setting, in which it occurs, and the roles of the social agency and the social worker in using community resources in helpful ways. The relationship of study and history to psychosocial diagnosis and the formulation of appropriate treatment plans.

(Germain, McCall.)

SW 222, 223. Social Casework. (2, 2)

Both semesters, second year. Further elaboration of basic concepts and introduction of more complex ideas. Case analysis directed toward development of skill in psychosocial diagnosis. Emphasis on selection of casework treatment techniques consistent with treatment objectives. Short-term and long-term casework treatment problems. Similarities and differences in casework practices in such varied settings as family and children's agencies, public assistance agencies, school social work departments, clinical (medical and psychiatric) services, correctional programs, etc. (Jennings, Ryan.)

SW 235. Group Methods in Social Work. (2)

Elementary concepts of social groupwork practice essential for the informed use of social groupwork resources in the community by social workers using casework methods. Application of theories of group behavior to understanding committee and other group processes within social agencies and professional and related organizations. Open to qualified part-time students with consent of instructor. (Jennings, Kahn, McCune.)

SW 240. Community Organization and Development. (2)

Basic concepts useful in facilitating citizen participation in neighborhood and community organization for social welfare. Analysis of methods used to achieve social objectives in community provision of needed services and prevention and control of psychosocial disorders. (Borom, Moses, Thurz.)

SW 241. Community Organization II. (2)

Continuation of SW 240 for students in C. O. concentration. Emphasis on neighborhood social work. (Borom, Moses, Thursz.)

SW 242, 243. Community Organization Methods. (2, 2)

(Both semesters, second year). Elaboration of basic concepts and methods of application. The role of the social worker in developing leadership and enabling neighborhood groups to identify and solve problems. Emphasis upon community organization process in intergroup relations in urban renewal, housing and settlement situations. (Thursz.)

SW 250. Social Welfare Administration. (2)

Second year. Elementary concepts of administration applicable to social welfare agencies. Staff participation in decision-making, policy formulation, and communication. Role relationships within administrative structures. Open to qualified part-time students with consent of instructor. (Lansdale.)

SW 260. Social Investigation. (2)

Second semester. Methods of research in social work. Problem formulation, data collection and analysis, presentation of findings, and conclusions. Attention to classic and recent studies. The relationships of research to social work knowledge. Open to qualified part-time students with consent of instructor.
(Chaiklin, McCune.)

SW 261, 262. Social Work Research. (2, 2)

Both semesters, second year. Analysis of significant social work studies and related social science research. A research report of substantial dimensions and high standards, presenting and analyzing findings of a study of some professional problem is required. (Chaiklin, Staff.)

SW 280, 281. Field Work: Basic Social Casework. (4, 4)

Both semesters, first year. Placement in community agencies for practice instruction in social casework method.
(Blumberg, Levi, McCall, Taylor, Staff.)

SW 282, 283. Field Work: Advanced Social Casework. (6, 4)

Both semesters, second year. Placement in community agencies for practice instruction in social casework method.
(Boucher, McCall, Maxwell and Staff.)

SW 285, 286. Field Work: Community Organization and Neighborhood Development. (5, 5)

Both semesters, second year. Placement in community agencies for practice instruction in community organization method. Prerequisite. successful completion of SW 280, 281 and related first-year courses.
(Borom, Keith, Thurz, Staff.)

SW 290. Special Social Work Problems. (1-3)

Individually planned study of selected substantial area of professional interest as arranged to meet special needs. Extensive reading, written and oral reporting as arranged by instructor. (Howard, Lansdale and Staff.)

The Graduate Council

Administrative Officers

BAMFORD, Ronald, Ph.D., Professor of Botany and Dean of the Graduate School

PRAHL, Augustus J., Ph.D., Professor of Foreign Languages and Associate Dean of the Graduate School

LYNHAM, Lucy A., B.A., Assistant to the Dean

Ex-Officio Members

ELKINS, Wilson H., D.Phil., President of the University

BYRD, Harry C., LL.D., D.Sc., President Emeritus

HORNBAKE, R. Lee, Ph.D., Vice President for Academic Affairs

BAMFORD, Ronald, Ph.D., Dean of the Graduate School

PRAHL, Augustus J., Ph.D., Associate Dean and Secretary of the Graduate Faculty Assembly

Appointed Members

ANASTOS, George, Ph.D., Professor of Zoology 1966

GRUCHY, Allan G., Ph.D., Professor of Economics 1967

MITCHELL, T. Faye, Professor of Home Economics 1969

PELCZAR, Michael J., Ph.D., Professor of Microbiology 1968

Elected Members

BECKMANN, Robert B., Ph.D., Professor of Chemical Engineering 1967

BODE, Carl, Ph.D., Professor of English 1967

CARDOZIER, V. R., Ph.D., Professor of Agricultural and Extension Education 1969

EYLAR, Ollie R., Ph.D., Associate Professor of Microbiology (Baltimore) .. 1969

GAUCH, Hugh, Ph.D., Professor of Plant Physiology 1969

HARRISON, Horace V., Ph.D., Professor of Government and Politics 1969

HOVET, Kenneth O., Ph.D., Professor of Education 1967

JACKSON, Stanley, Ph.D., Professor of Mathematics 1966

SCHAMP, Jr., Homer W., Ph.D., Professor of Molecular Physics 1969

SHAFFNER, Clyne S., Ph.D., Professor of Poultry Science 1968

SPARKS, David S., Ph.D., Professor of History 1968

THOMPSON, Arthur, Ph.D., Professor of Pomology 1966

WHITE, John I., Ph.D., Professor of Physiology (Baltimore) 1966

The Faculty

Professors

ADAMS, Elijah, Professor and Head of Department of Biological Chemistry
B.A., The Johns Hopkins University, 1938; M.D., University of Rochester, 1942.

ALDRIDGE, Alfred O., Professor of English and Director of Comparative Literature
B.S., Indiana University, 1937; M.A., University of Georgia, 1938; Ph.D., Duke University, 1942; Docteur de l'Universite de Paris, 1955.

ALLEN, Redfield W., Professor of Mechanical Engineering
B.S., University of Maryland, 1937; Ph.D., 1949.

ALLEN, Russell B., Professor of Civil Engineering and Assistant Dean of College of Engineering
B.S., Yale University, 1923.

ANASTOS, George, Professor of Zoology
B.S., University of Akron, 1942; M.A., Harvard University, 1947; Ph.D., 1949.

ANDERSON, Thornton H., Professor of Government and Politics
A.B., University of Kentucky, 1937; M.A., 1938; Ph.D., University of Wisconsin, 1948.

ANDERSON, Vernon E., Professor and Dean of the College of Education
B.S., University of Minnesota, 1930; M.A., 1936; Ph.D., University of Colorado, 1942.

ANDREWS, Thomas G., Professor and Head of Department of Psychology
B.A., University of Southern California, 1937; M.A., University of Nebraska, 1939; Ph.D., 1941.

ARBUCKLE, Wendell S., Professor of Dairy Science
B.S.A., Purdue University, 1933; A.M., University of Missouri, 1937; Ph.D., 1940.

AVERY, William T., Professor and Head of Classical Languages and Literatures
B.A., Western Reserve University, 1934; M.A., 1935; Ph.D., 1937; Fellow of the American Academy in Rome, 1937-1939.

BAMFORD, Ronald, Professor of Botany and Dean of the Graduate School
B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; Ph.D., Columbia University, 1931.

BATTIG, William F., Professor of Psychology
B.S., Northwestern University, 1951; M.S., University of Wisconsin, 1953; Ph.D., 1955.

BAUER, Richard H., Professor of History
Ph.D., University of Chicago, 1923; M.A., 1928; Ph.,D., 1935.

BEAL, George M., Professor of Agricultural Economics and Marketing
B.S., Utah State Agricultural College, 1934; M.S., University of Wisconsin, 1938; Ph.D., 1942.

BECKMANN, Robert Bader. Professor and Head of Department of Chemical Engineering

B.S., University of Illinois, 1940; Ph.D., University of Wisconsin, 1944.

BESSMAN, Samuel P., Professor of Pediatrics and Biochemistry

M.D., Washington University Medical School, 1944.

BICKLEY, William E., Professor and Head of Department of Entomology

B.S., University of Tennessee, 1934; M.S., 1936; Ph.D., University of Maryland, 1940.

BINGHAM, Alfred Jepson, Professor of Foreign Languages

B.A., Yale University, 1933; Ph.D., Columbia University, 1939.

BLAKE, William Dewey, Professor and Head of Department of Physiology

A.B., Dartmouth College, 1940; M.D., Harvard Medical School, 1943.

BLOUGH, Glenn O., Professor of Education

A.B., University of Michigan, 1929; A.M., 1932; LL.D., Central Michigan College of Education, 1950.

BODE, Carl, Professor of English

Ph.B., University of Chicago, 1933; M.A., Northwestern University, 1938; Ph.D., 1941; Fellow of the Royal Society of Literature of the United Kingdom.

BRACE, John W., Professor of Mathematics

B.A., Swarthmore College, 1949; A.M., Cornell University, 1951; PH.D., 1953.

BRADY, Joseph Vincent, Professor of Psychology (P.T.)

B.S., Fordham University, 1943; Ph.D., University of Chicago, 1951.

BURDETTE, Franklin L., Professor of Government and Politics and Director of the Bureau of Governmental Research

A.B., Marshall College, 1934; A.M., University of Nebraska, 1935; A.M., Princeton University, 1937; Ph.D., 1938; LL.D., Marshall College, 1959.

BURGISON, Raymond M., Professor and Acting Head of Pharmacology

B.S., Loyola College, 1945; M.S., University of Maryland, 1948; Ph.D., 1950.

BYRNE, Richard H., Professor of Education

A.B., Franklin and Marshall College, 1938; M.A., Columbia University, 1947; Ed.D., 1952.

CAIRNS, Gordon M., Professor of Dairy Science and Dean of College of Agriculture

B.S., Cornell University, 1936; M.S., 1938; Ph.D., 1940.

CARDOZIER, V. R., Professor and Head of Department of Agricultural and Extension Education

B.S., Louisiana State University, 1947; M.S., 1950; Ph.D., Ohio State University, 1952.

CARL, Mary K., Professor of Nursing

B.S., Johns Hopkins University, 1946; Ph.D., University of Maryland, 1951.

CHAPMAN, Erna R., Professor and Acting Dean of College of Home Economics
B.S., University of Maryland, 1934; M.S., 1939.

CHU, Yaohan, Professor in Electrical Engineering
B.S., Chiao-Tung University, 1942; M.S., Massachusetts Institute of Technology, 1945; ScD., 1953.

CLEMENS, Eli W., Professor of Business Organization
B.S., Virginia Polytechnic Institute, 1930; M.S., University of Illinois, 1934; Ph.D., University of Wisconsin, 1940.

COHEN, Leon W., Professor and Head of Department of Mathematics
B.A., Columbia University, 1923; M.A., 1925; Ph.D., University of Michigan, 1928.

COMBS, Gerald F., Professor of Poultry Nutrition
B.S., University of Illinois, 1940; Ph.D., Cornell University, 1948.

COOK, J. Allen, Professor of Marketing
A.B., College of William and Mary, 1928; M.B.A., Harvard University, 1936; Ph.D., Columbia University, 1948.

COOLEY, Franklin D., Professor of English
A.B., Johns Hopkins University, 1927; M.A., University of Maryland, 1933; Ph.D., Johns Hopkins University, 1940.

CORNING, Gerald, Professor of Aeronautical Engineering
B.S., New York University, 1937; M.S., Catholic University, 1954.

COSTELLO, Leslie C., Professor of Anatomy and Physiology
B.S., University of Maryland, 1952; M.S., 1954; Ph.D., 1957.

CRENSHAW, John Walden, Jr., Professor of Zoology
B.A., Emory University, 1948; M.S., University of Georgia, 1951; Ph.D., University of Florida, 1955.

CUMBERLAND, John H., Professor of Economics
B.A., University of Maryland, 1947; M.A., Harvard University, 1949; Ph.D., 1951.

CURTIS, John M., Professor and Head of Department of Agricultural Economics
B.S., North Carolina State, 1947; M.S., 1949; Ph.D., University of Maryland, 1961.

DASTON, Paul George, Professor of Psychology
A.B., Northeastern University, 1948; M.A., Michigan State University, 1950; Ph.D., 1952.

DAVIS, Richard F., Professor and Head of Dairy Science
B.S., University of New Hampshire, 1950; M.S., Cornell University, 1952; Ph.D., 1953.

DAY, Thomas B., Professor of Physics
B.S., University of Notre Dame, 1952; Ph.D., Cornell University, 1957.

DE VOLT, Harold M., Professor of Veterinary Science
B.S., Cornell University, 1936; D.V.M., 1923; M.S., 1926.

DILLARD, Dudley, Professor and Head of Department of Economics
B.S., University of California, 1935; Ph.D., 1940.

DILLON, Conley H., Professor of Government and Politics
A.B., Marshall College, 1928; A.M., Duke University, 1933; Ph.D., 1936.

DITMAN, Lewis P., Professor of Entomology
B.S., University of Maryland, 1926; M.S., 1929; PH.D., 1931.

DOETSCH, Raymond N., Professor of Microbiology
B.S., University of Illinois, 1942; A.M., Indiana University, 1943; Ph.D., University of Maryland, 1948.

DOORENBOS, NORMAN J., Professor of Pharmaceutical Chemistry
B.S., University of Michigan, 1950; M.S., 1951; Ph.D., 1953.

DORSEY, Brice M., Professor and Head of Department of Oral Surgery
D.D.S., University of Maryland, 1927.

DOUGLIS, Avron, Professor of Mathematics
A.B., University of Chicago, 1938; M.A., New York University, 1949; Ph.D., 1949.

DUFFEY, Dick, Professor of Chemical Engineering
B.S., Purdue University, 1939; M.S., University of Iowa, 1940; Ph.D., University of Maryland, 1956.

DUFFEY, Robert V., Professor and Head of Early Childhood Education
B.S., Millersville State Teachers College, 1938; Ed.M., Temple University, 1948. Ed.D., 1954.

EDGERTON, Harold A., Professor of Psychology (P.T.)
B.S., Kansas State Teachers College, 1924; M.A., Ohio State University, 1926; Ph.D., 1928.

ELKINS, Wilson H., President, University of Maryland
B.A., University of Texas, 1932; M.A., 1932; LITT.B., Oxford University, 1936; D.PHIL., 1936.

ESTABROOK, Gaylord B., Professor of Physics
B.Sc., Purdue University, 1921; M.Sc., Ohio State University, 1922; Ph.D., University of Pittsburgh, 1932.

EYLER, Marvin Howard, Professor of Physical Education
A.B., Houghton College, 1942; M.S., University of Illinois, 1948; Ph.D., 1956.

FABER, John E., Jr., Professor and Head of Department of Microbiology
B.S., University of Maryland, 1926; M.S., 1927; Ph.D., 1937.

FERRELL, Richard A., Professor of Physics
B.S., California Institute of Technology, 1948; M.S., 1949; Ph.D., Princeton University, 1952.

FIGGE, Frank H. J., Professor and Head of Department of Anatomy
A.B., Colorado College, 1927; Ph.D., University of Maryland, 1934.

FISHER, Allan J., Professor of Accounting and Finance
B.S., University of Pennsylvania, 1928; LITT.M., University of Pittsburgh, 1936; Ph.D., 1937.

FISHER, Russell S., Professor of Legal Medicine, School of Medicine
B.S., Georgia School of Technology, 1937; M.D., Medical College of Virginia, 1942.

FOSS, Noel E., Professor and Dean of School of Pharmacy
Ph.C., B.S., South Dakota State College, 1929; M.S., University of Maryland, 1932; Ph.D., 1933.

FOSTER, John E., Professor and Head of Department of Animal Science
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THE UNIVERSITY is the rear guard and the advance agent of society. It lives in the past, the present and the future. It is the storehouse of knowledge, it draws upon this depository to throw light upon the present, it prepares people to live and make a living in the world of today, and it should take the lead in expanding the intellectual horizons and the scientific frontiers, thus helping mankind to go forward —always toward the promise of a better tomorrow.

From "The State and the University"
the inaugural address of
President Wilson H. Elkins,
January 20, 1955,
College Park, Maryland